1859 FIFTY-EIGHTH YEAR 1916

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The most efficient method of carbonizing coal is in KOPPERS OVENS and the best coke and by-products are produced by this process.

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AMERICAN

GAS LIGHT JOURNAL

VOL. CV., No. 24. NEW YORK, DECEMBER 11, 1916 WHOLE No. 3,066.

# Gas Coke Has Decided Advantages Over All Other Household Fuels

## Handling and Preparation of Saleable Coke is Not an Operation that may be Subjected to Searching Chemical Analysis, but Result of Years of Study of Different Methods as Seen in Practical Operation

By HERBERT E. BIRCH

FIG. 16: 1,500 TON CONCRETE STORAGE BUNKER, CAMDEN COKE COMPANY, CAMDEN, N. J.

It is becoming well known among works operators that to sell coke in competition with anthracite coal it is necessary to have a product which more than compares favorably with it. A consumer who has been buying anthracite for years will not change to a new fuel unless the advantages overcome his prejudice.

We know ourselves what these advantages are but the average householder does not. He does not know that tests with a house-heating furnace using domestic fuels showed that the cost of raising 1,000 lb. of water 100 deg. Fahr. was 4.19 cents, using anthracite and 2.61 cents using gas coke. These tests were made by the American Radiator Company, and proved that gas coke has a decided advantage over all other household fuels, being easy to control, burns evenly and smokelessly, kindles easily and is clean to handle.

To get this and kindred information before the public is a sales problem and much is yet to be done in educating the people to a point where they will consider using coke. At present, the majority look upon it as a poor man's fuel, purchasable at the corner grocery in 10 cent bags. Perhaps their pride prevents their becoming regular coke customers, but whatever it is, let us give the sales department a good, clean, silvery coke. They have a Herculean task without being further burdened with a black dirty fuel to sell.

While the problem of producing good, clean, commercial coke is by no means a new one, the results attained in some plants lead one to believe that it is simply lack of knowledge of the methods and machines available that is responsible rather than carelessness on the part of the operator. The coking process is under excellent care until the coke leaves the retorts when it is usually subjected to a gross mishandling, the wonder being in that there is any saleable product left.

Perhaps a contributing cause is that our scientists, having told us how best to operate from a chemical viewpoint, do not care what we do with our coke after they are through with it, nor how we do it. The proper handling and preparation of the product is not an operation that may be subjected to a searching chemical

FIG. 6: BALANCED SKIPS AT BOSTON CONSOLIDATED GAS COMPANY

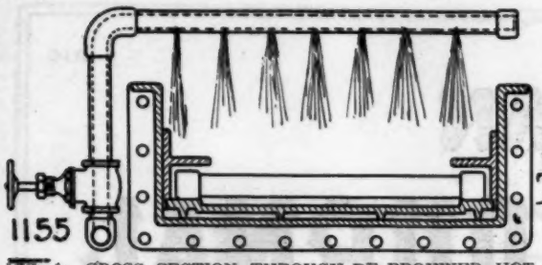


FIG. 1: CROSS SECTION THROUGH DE-BROUWER HOT COKE CONVEYOR AND QUENCHER

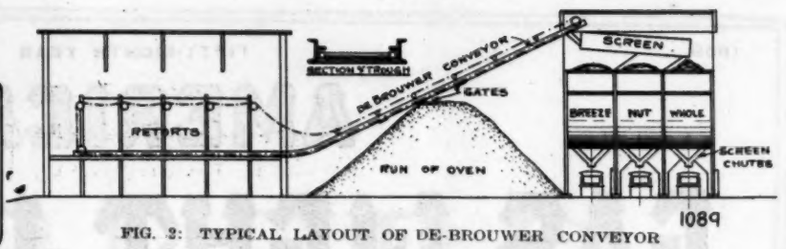


FIG. 2: TYPICAL LAYOUT OF DE-BROUWER CONVEYOR

analysis, and consequently does not appeal to them. It is the result of years of study of different methods, as seen in practical operation; the result of experiments by operators, by builders, who must of necessity satisfy themselves of the feasibility of a method before tying up their capital and risking their reputation by proposing the wide use of a device before it has been thoroughly tried out.

From the foregoing, it is seen that we have a problem entirely different to those encountered when considering the handling and preparation of coal, which is by nature graphitic and as such, causes little wear to the conveying medium. Any of the well known types may be chosen with expectations of reasonable first cost and upkeep.

When considering coke handling and preparation, we encounter entirely different factors. Coke is extremely abrasive and few machines on the market to-day handle it successfully, owing to the destructive action of the coke on such vital parts as the chain joints, and the rapid deterioration of the machine caused by the acids released when the hot coke is quenched. The abrasiveness of coke can be more readily appreciated when it is found that it is one of the four articles used in the manufacture of Carborundum, the well known abrasive product.

An even more vital problem presents itself when one considers the delicate structure and spongy texture of coke. J. W. Schaeffer of Milwaukee aptly defines coke as an "imaginary material being a cross between an egg, an emery wheel, and a sponge." If you disregard the emery wheel element you wear out your handling apparatus, and the egg and sponge ends must be respected if satisfied customers are desired.

### Quenching and Conveying to Screens

Keeping the above well in mind, let us first consider the various methods used to take the coke as it comes from the retorts and deliver it to a point overhead, ready for sizing. We will confine ourselves to successful devices, leaving experiments entirely out of consideration. The methods used to accomplish this may be by the application of a continuous bulk conveyor, by intermittent bulk conveyors or by a combination of both. Each will be described in the order mentioned.

An excellent example of the continuous bulk conveyor for handling red hot coke is the deBrouwer hot coke quenching conveyor. It consists of two strands of special short pitch sliding chain, with flat iron cross-bars at intervals of about two feet, the whole operating in a water tight trough varying from 8 to 12 in. deep. The trough is sometimes made of steel and sometimes of cast iron, but in either case, it is always lined with hard cast iron plates, both on the bottom and on the sides. The driving sprockets are of special design, having manganese steel teeth. At all other turns, plain traction wheels are used. Fig. 1 shows a cross-section of the conveyor using a cast iron trough. The return run may be carried back either above or below the trough, usually the former, as then it may be placed high enough to clear everything, say at about the height of the setting, the idler wheels being supported by brackets secured to the buckstays.

Coke discharged from the retorts is usually concentrated in the trough by a slot feed hopper. This is simply a plate hopper large enough to receive the discharge from one retort, and having a long and comparatively narrow outlet to distribute the coke evenly in the trough, the whole being mounted on four wheels arranged to run on the conveyor trough, using the upper trough flanges as rails. The object of this device is to assist in attaining good quenching, and to do so, it is essential that the distribution of the coke in the trough be in a uniform thin layer, as the water-spray cannot be expected to quench varying depths of coke alike.

At each bench a quenching pipe is located, this giving a preliminary spraying to arrest combustion. The final spray is located at the end of the retort house where the conveyor rises for the incline run to the screening plant. At this point, water return troughs are sometimes provided to drain off the surplus water carried up the incline with the coke, and deliver it back to the quenching portion of the conveyor.

By this means positive drainage is secured, the resulting coke showing very little moisture, the percentage varying with the size of the coke and the quantity of water used.

The simplicity of this device is one of its strong features. The moving parts are light and strong and admit of quick and easy repair. The chain pins are tool steel and the sliding shoes high carbon cast steel, with wearing shoes. The feeding to, and the discharge from, the trough could not be simpler. The capacity can be made ample to take care of any size gas house. Breakage is slight because coke is not dropped violently into or out of the conveyor. Fig. 2 shows a typical arrangement of a deBrouwer conveyor delivering to an overhead screening house. Note the large amount of ground storage or run-of-oven coke that may be stored. Fig. 3 shows the application to horizontal troughs at Taunton, Mass.

Sometimes, the deBrouwer delivers to a belt conveyor at the end of the retort house, this belt being inclined for the run to the screen house. This arrangement is economical when the screen house must be located at some distance from the retort house. When the deBrouwer can rise at its maximum angle immediately upon emerging from the retort house, a separate belt conveyor should not be used.

Considering the second of the three cases, the intermittent bulk method, we find three distinct methods commonly used; namely, (A)—car in retort house with platform elevator to lift it to screening station; (B)—car in retort house with skip hoist to elevate to screening station; (C)—car in retort house and grab bucket telpher to hoist and convey.

### Method "A"

This is perhaps the oldest of the three. The car is usually small, with large flat tread wheels and (36 in. in diameter) easily pushed by one man. The body is made of light plate, so that renewals are cheap. The platform elevator is an ordinary freight elevator and needs no description. The disadvantages are:

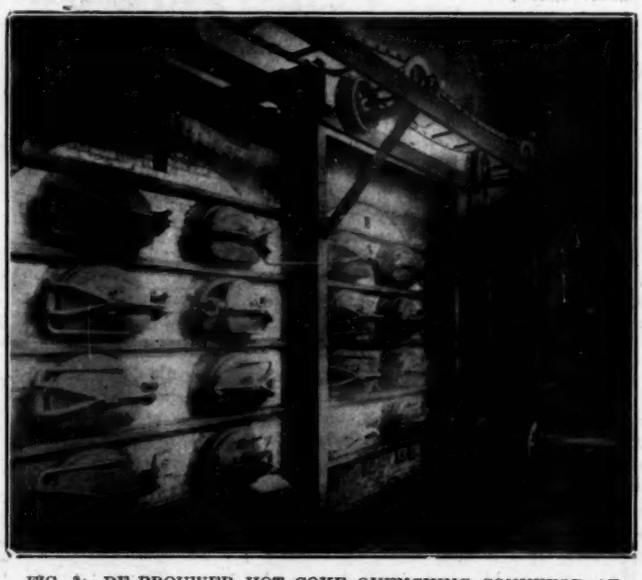

FIG. 3: DE-BROUWER HOT COKE QUENCHING CONVEYOR AT TAUNTON, MASS.

Low capacity, the fact that it requires the attention of a man throughout the entire cycle, and costs almost as much as a system in which the man is not required except on the retort house floor. There are no advantages, except where labor is very cheap and plentiful.

METHOD "B"

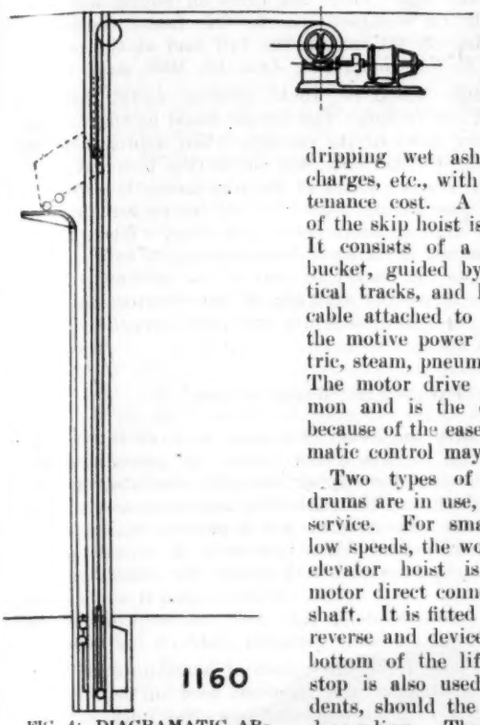


FIG. 4: DIAGRAMATIC ARRANGEMENT OF SKIP HOIST

The car and skip system was devised to handle gritty and wet materials such as red hot or dripping wet ashes, blast furnace charges, etc., with a very low maintenance cost. A diagramatic view of the skip hoist is shown by Fig. 4. It consists of a rectangular steel bucket, guided by inclined or vertical tracks, and hoisted by a steel cable attached to a winding drum, the motive power being either electric, steam, pneumatic, or hydraulic. The motor drive is the most common and is the one recommended because of the ease with which automatic control may be secured.

Two types of electric winding drums are in use, depending on the service. For small capacities and low speeds, the worm geared freight elevator hoist is used, with the motor direct connected to the worm shaft. It is fitted with an automatic reverse and device to stop it at the bottom of the lift. A slack cable stop is also used to prevent accidents, should the bucket jam when descending. The entire operation is automatic, and therefore, foolproof. A pull on the starting rope, causes the skip bucket to ascend, dump, reverse and descend, coming to rest in the pit without further attention from the operator, who meanwhile has another load ready to dump into the bucket.

The machine used when a high hoisting speed is necessary to obtain greater capacity is spur geared, the motor being connected to the countershaft by a cut spur gear and pinion, the whole being mounted on a heavy steel base.

On account of the high speed at which the bucket is hoisted, it is necessary to provide means to slow it down when approaching the dumping point, or the pit, at the completion of the cycle.

This is accomplished automatically by an electrical control system. The workman pushes the starting button, when the skip bucket will get under way slowly, accellerating to full speed in the first 10 ft. of travel and continue at full speed until within 10 ft. of the dumping point. At this instant, the slow-down switches are automatically brought into play and when the bucket dumps, the speed has been reduced sufficiently to permit this. The bucket is lowered by means of dynamic braking, as is done in standard elevator practice, to avoid the wear and tear common with mechanical brakes. In addition, an electric brake is provided to support the load when machine is stopped, or in case of current failure.

Three controlling push buttons are provided, up, down, and stop, the latter two being used in emergencies only. In case of current failure on either the up or down trip, the bucket is lowered by pushing the "down" button. The bucket is stopped at any point by pushing the "stop" button and is lowered again by pushing the "down" button. Pushing the "up" button has no effect under these conditions.

The capacity of any skip system may be doubled by making it the balanced type. This is done by installing two complete sets of guides, ropes, buckets, sheaves, etc., but leading both of the hoisting ropes to the same winding machines, fastening them to the drum in such a manner that one bucket is dumping while the other is loading. It is seen that the buckets balance each other at all times, leaving only the contents of one bucket to be hoisted. Care must be taken, however, to design the winding machine for the weight of both buckets and one load, as all of this is supported by the drum shaft and bearings. Fig. 5 shows a balanced skip system delivering to a crushing and screening plant.

WHEN TO USE SINGLE AND BALANCED SKIPS

The question which naturally arises now is when to use a single and when a balanced skip. This should be decided by the application of the operating, maintenance, interest formula, and the one showing the greater return on the investment used. The first cost does not prove anything, as the cheapest method may require more men to operate, take more power, or it may be that the depreciation is greater. The standard practice of the R. H. Beaumont Company, subject, of course, to local conditions, is approximately as follows: Single skips with slow speed worm-geared hoist, 20 to 50 cu. ft. bucket, increasing by fives. Single skips, spur geared high speed hoist, 50 to 100 cu. ft. bucket, increasing by tens. Balanced high speed skips are built with 60 to 100 cu. ft. buckets, the hourly capacity being double that of the single high speed skip. The smaller buckets should never be run balanced, as it is more economical to use a single high speed machine.

The capacities of the skip hoists range from 6 to 150 tons per hour for standard sizes and speeds, giving a very wide range of machines from which to select the most economical for any particular plant. Fig. 6 shows a high speed balanced skip installation at the Boston Consolidated Gas Company's works, which has a capacity of 90 tons per hour. The system receives coke in railroad cars from the by-product plant and delivers to overhead bunkers for use in the water gas house. Automatic loaders are used in the pit, being operated by the buckets themselves, eliminating an attendant at this point. Single skips are sometimes counterweighted to cut down the power consumption, but one must look carefully into this, as the carrying charges on the additional expense incurred may be greater than the saving in power.

The advantages of the skip system are, as follows: It is not affected by heat, grit or water. Coke may be handled in any condition, and when a load has been dumped into the bucket it lies dormant and remains so until it is dumped out. The winding drum is the only part of the entire system which would suffer from the effect of grit from coke dust, etc., and this is always placed in a remote location, inside of any available building, or if this is impossible, a separate shelter is built for it at a small cost. The skip bucket, cable and head sheaves are the only parts left to wear and these easily last from 6 to 10 years.

LARGE CAPACITY EASY TO ATTAIN

Large capacity is easy to attain. There is practically no limit to the amount of coke which may be hoisted. The standard sizes which have been developed will take care of the output of any size gas works. A small skip may be installed at first, to take care of the initial output, and later, may be increased in capacity by making the bucket larger, it running in the same guides. It would also be necessary to use a larger motor, but additional

FIG. 7: CONCRETE BUNKER AND TELPHER RUNWAY AT LYNN, MASS.

horse-power does not cost much more if the larger size is installed with the original equipment. Then again, by changing the hoist entirely to a high speed type, the capacity is easily trebled. This is possible with no other system.

Coke can be hoisted to practically any height by the skip without affecting any part of the apparatus. All that is necessary is to have sufficient rope and a drum wide enough to wind it on. If a ¾-in. cable is required for a 40 ft. lift, it is ¾-in. for a 140 ft. or any lift. With most elevators and conveyors, high lift presupposes a heavy expensive chain, with excessive wear and frequent renewals, etc.

The skip hoist requires only part of one man's time, and he is the one who brings the coke to the skip. All that is necessary is for him to push a button or throw a switch, as the case may be, then go and get more coke. This skip hoist does the rest. No attendant is required when the machine is running.

A skip hoist consumes less power than any other type of equipment having the same capacity. The skip runs only when doing work, whereas other types frequently run empty or only partly loaded and therefore, the frictional losses are very large.

As mentioned before, the winding machine is the only actual piece of machinery, and this is placed in a position remote from the skip. This feature is exclusive with the skip hoist, being the only device where the motor and machinery are not subjected to the abrasive action of coke dust.

As mentioned before, the only wearing parts are the bucket, cable and head sheave and these last for years and are easily replaceable without shutting down the plant for more than a couple of hours. Renewals and repairs other than these are minor ones and can be made by the plant blacksmith. No stock of expensive spare parts need be carried.

The skip handles coke gently and with minimum breakage, because after the coke is dumped into the bucket it lies dormant and remains so until discharged into the head receiving hopper over the screens.

The skip tracks do not have to run vertically. In fact, at least half the time, they are on an incline, which can be made as flat or as steep as desired, to suit local conditions. The car which delivers to the skip bucket may be a flat wheel coke buggy, industrial car, quenching car, or any of the numerous types of cars in use, all practically performing the same function and using the same amount of labor. On large plants, sometimes an electric endless rope haul is used to pull the car to the skip pit.

### Method "C"

The retort house car used in system "B," may deliver to a pit just outside of the retort house, from which it is taken to the screen house by a grab bucket telpher, operating upon an overhead runway. The advantages of this arrangement are, as follows: The telpher will handle coke to and from ground storage, eliminating the necessity of having additional equipment for this purpose. In this connection, the coal reserve may be handled by it, effecting a similar saving. It will also serve the purifying boxes.

The path through which a telpher will transport material is limited only by the necessity of having a runway for the machine to operate upon and this can follow any devious course, just so the curves are of ample radius to premit of high speed operation. Small radius curves cut down the capacity of the outfit.

The structural design of the large telpher runway presents many problems which the average engineer does not dream exists, simply because he is not familiar with the operation of a telpher system, nor with the action of large ground storage piles when being reclaimed. The design of bridges or buildings is his forte and no one shall say to him "you know not your business," when he is engaged in work of this character.

But let him approach the design of a high telpher runway, especially where the telpher is to operate at a high speed to get capacity and it's a safe bet that the plant will be muddled.

Let us mention a few of the cardinal points he is apt to neglect. First, the columns supporting the overhead bridge must be designed for a ratio of $l/r = 100$, the reason being to protect them against the shock of avalanching coke. The writer has seen coke piles standing almost vertical where the bucket is digging and when this wall tumbles to its normal angle of repose, the resulting shock is terrific. Fig. 7 shows a telpher runway at Lynn, Mass., where the columns in the coke pile are 15-in. Bethlehem girder beams. In this case, to satisfy the stresses from a structural engineer's viewpoint, it would have been possible to use a section weighing much less than was used.

Second, but few structural designers consider the danger from rivet heads in tension. They would probably suspend the track beam from the cross support by four rivets, being all that could be placed in a connection of this nature. One who was "wise" would avoid this. There are cases on record where the telpher and track has collapsed due to this faulty design, the rivet heads popping off the instant the full load of the machine reached them. (*Engineering News, June* 10, 1915, *page* 1,1 9.)

Third, the design which he would produce would limit the hourly capacity of the system. The curves would be small, necessitating the slowing down of the machine when approaching and turning the curve. Furthermore, the supporting bents would be cross braced up to a small panel at the top, barely large enough for the telpher to pass through, thus forcing the operator to hoist the bucket to its highest point before traveling. When a man is pushing his machine to its absolute maximum, he must be able to travel as soon as the bucket is clear of the ground pile and this he cannot do unless the designer of the structure was conversant with the operation of conveying machinery, as well as with the details of his own business.

### Fault Lies With Owner

The fault lies with the owner, for cases such as this usually occur when he tries to save a few dollars by parceling out a split up contract, buying the telpher here, the conveying machinery, screens, etc., there, and the steel from somewhere else. There is no one to tie up the loose ends, no one responsible who will back up what they do with more than promises. If things do not work out right, each contractor will blame the other; perhaps justly so, perhaps not. It is human nature to pass it along to the other fellow, but unfortunately, this does not help the owner, who is usually left with a badly designed plant on his hands.

Taking now the last of the three cases of handling coke to the screens, by a combination of the machines used in the first two methods, we find the following four are the ones favored: Method "D," deBrouwer in retort house and skip hoist; "E," deBrouwer in retort house and telpher; "F," car in retort house and deBrouwer; "G," car in retort house and belt conveyor. In "D," care must be taken to provide an equalizing bunker to effect a balance between the continuous operation of the deBrouwer and the intermittent operation of the skip. This should be made large enough to act as a night storage bin to avoid running the skip and screens at night. This principle applies to "E," "F" and "G" also.

In "F," the car delivers to the deBrouwer, which is used as a quenching conveyor, while in "G," we must deliver cold quenched coke to the belt, therefore, the coke is quenched in the car, which discharges on a sloping cooling wharf, hot spots then being quenched by hand. Delivery to the belt is controlled by rotary feeders and finger gates, which operate in sections about six feet long, so that the last coke received at the wharf may be held there, but permitting the handling of the cold coke. This latter method is standard with by-product plants.

### Screening Systems

We will now discuss the preparation of the coke, giving a brief description of the various auxiliaries in daily use. No attempt will be made to determine which device is best, for there are too many governing conditions (the principle one being the ideas of the purchaser of the equipment).

The rotary feeder consists of a short cast-iron overshot paddle wheel, set in a cast-iron chute. Placed at a hopper outlet, it obstructs the flow of coke when stationary, and feeds the coke forward when it revolves. Regulation is accomplished by altering the speed and by a slide gate at the hopper outlet.

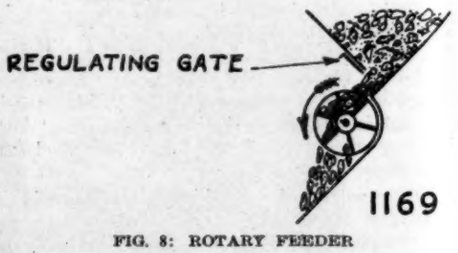


FIG. 8: ROTARY FEEDER

### Vibrating Feeder

This consists of a short cast iron chute set below the hopper outlet, on a slight downward inclination, but not sufficient to permit the coke to flow unless the chute (feeder) is vibrated. The chute is actuated by eccentrics set on a shaft receiving power from the machine being fed. The angle of inclination is adjustable and regulates the feed. A slide gate at the hopper opening gives additional adjustment.

FIG. 9: VIBRATING FEEDER

Apron feeders consist of two roller chains carrying continuous overlapping corrugated steel slats having vertical sides, to form a trough in which the material is conveyed. They are particularly useful where the coke must be elevated in addition to the feed being regulated.

Crushers for coke should always be the double roll type, of massive design and above all, should have fluted segmental rolls, the segments being preferably of manganese steel, as the additional cost of this material is slight in comparison with the service rendered. The crusher should be of such design that the segments can be taken off without disturbing the rolls. Because most plants, and particularly new ones, do not know just what size is going to have a run, and because the demand for any size is variable, it is advisable to have a crusher with rolls arranged so that the opening may be quickly adjusted, and through a wide range. This adjustment should be positive and made without the use of sliding or bevel gears. Relief springs should not be used as their action is not uniform when crushing coke of varying hardness.

A crusher of this type is illustrated by Fig. 10, the rolls being adjustable radially, with the driving pinion of each roll as a center. This crusher is adjustable from 1 to 6 in., producing a maximum of the size for which it is set, and is patented by the Beaumont Company.

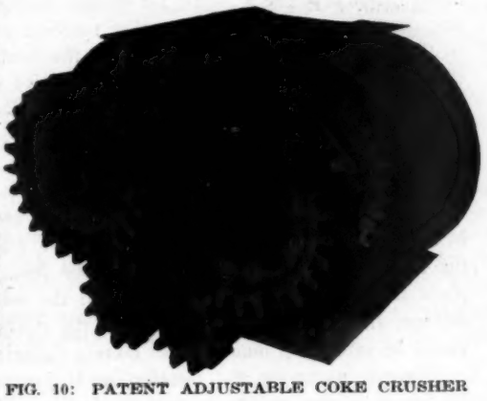
FIG. 10: PATENT ADJUSTABLE COKE CRUSHER

All crushers, small or large, fixed or adjustable rolls, cost less to operate when evenly fed by means of one of the three devices just described. Coke delivered to a crusher, whether from a chute or a conveyor, will be concentrated practically in the center of the rolls, and under these conditions, the flutes wear rapidly, and soon the reduction in diameter at the center makes proper sizing impossible. The saving in repairs alone justifies the installation of a feeding device above a crusher.

Sometimes, four roll crushers are used, the purpose being to reduce the percentage of fines. If this is done, the discharge from the first pair of rolls to the second pair should be over a bar screen to remove all pieces that are already small enough. The upper pair of rolls are set wider apart than the lower pair, which are set to produce the size desired. The upper rolls need not be adjustable.

Bar screens are of three general types, the plain fixed bars, removable bars, and removable bars in which the pitch of the bars is adjustable, and also the pitch of the entire screen as a whole. Fixed bars need no description other than to say that they should not be used when a better device can be secured at about the same cost.

A screen in which the bars are of cast iron and tapered both in the direction of the flow and also vertically, to prevent clogging, can be built very economically.

They are built with socket ends to rest on the upper and lower cross rods, the spacing between each bar being maintained by packing with washers. This permits of an adjustment of the spacing, or the quick removal of the bars to clean the screen.

Following this idea a step further, if we make the lower rod adjustable, the movement being radial with the upper rod as a center, we get a very efficient screen, which can be built with any number of these adjustable sections, forming a series of steps over which the coke travels in a cascade effect. These small drops turn over the coke and shake off the damp clinging breeze, but the drop is too slight to affect the coke adversely. The entire screen is pivoted at its upper end so that the total pitch adjustment is through a wide range. The cascade coke grizzly, having these features, is patented by the Beaumont Company, the general design being as shown by Fig. 11.

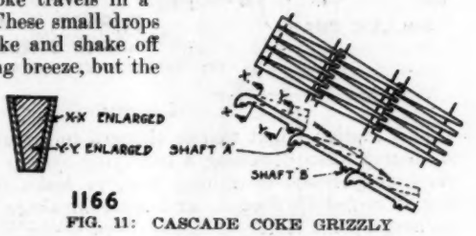

FIG. 11: CASCADE COKE GRIZZLY

### Rotary Screens of Two Main Types

Rotary screens are of two main types, single and multiple (jacketed) cylinders. The single cylinder screen may be built with a through shaft and supporting spokes, or it may be built inside of a structural steel skeleton and supported by steel tires resting on chilled charcoal iron rollers. The advantages of the first screen is low cost, but it cannot be used if the screen is very long. It is very satisfactory for small plants where only the breeze is removed. When the screen becomes longer, it is impossible to support the weight on a long shaft and therefore an independent structural steel frame is built and the screen plates bolted to it. In this type of screen, wear on the plates does not weaken it, and the entire cylinder is free from any interior obstruction. (With the through shaft screen, the supporting spokes revolving and cutting through the mass of coke causes breakage.) A screen of this type is shown by Fig. 12.

### Vibrating Screen

What has proven to be an excellent coke screen for retort coke is the balanced vibrating type. This is a German invention and consists of two horizontal screen pans of light plate construction, which are given a rapid vibrating motion by means of opposed eccentrics. The pans are suspended from a strongly braced steel framework by laminated wood strips made of the best obtainable ash or hickory. This type of screen gives the coke a thorough agitation without the rough handling which occurs in others. The flexible wood supports are set at an inclination, which, together with the ½-in. throw of the eccentric, gives a motion that is both forward and upward, the result being that the coke is propelled along the screen pans in an evenly spread thin layer and without breakage. The advantage of this device is the absence of wearing parts which adapt it especially to handling coke. The cost of upkeep is very low due to this absence and to the fact that the bottom plate of the screen pan (practically the only part that wears) may be made of manganese steel. Fig. 13 shows a diagramatic outline of this screen and Fig. 5 shows it in its relation to a complete plant. It should be belt driven, the power being received usually from a main countershaft, which also drives the crusher and feeder. A few more facts, mainly of caution, will be given under the heading of "Bunkers," regarding supports for vibrating screens.

The disc screen, or rotary grizzly, consists of six (more or less) parallel shafts on which are mounted 18-in. diameter saw-tooth chilled cast-iron discs, the entire set being mounted on a steel frame with ⅝" cast-iron side liners. The pitch of the frame is adjustable and means are provided to vary the mesh. It has been used principally as a primary screen in by-product plants to separate the metallurgical from the domestic coke.

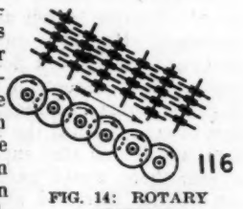

FIG. 14: ROTARY GRIZZLY

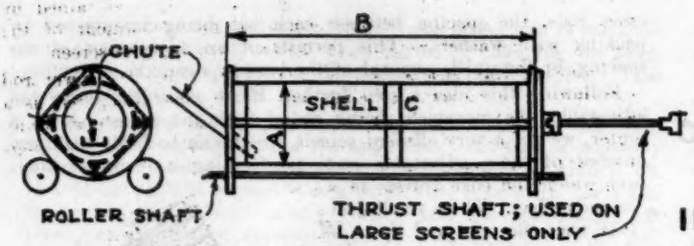


FIG. 12: ROTARY TRUNION SCREEN

## Chutes

This caption might well be changed to "trouble." A good rule to observe when designing a conveying system is to avoid chutes wherever possible, or failing that, to make them short. They clog if not steep enough, and cause breakage by impact at the discharge point if they are too steep.

If the chute is steel, it is apt to rust overnight and then the pitch must be greater than when it has worn smooth again. One common fault that must be avoided is a chute with converging sides, as perhaps nothing will cause it to clog up quicker.

They should be wide and shallow to avoid side friction, as that on the bottom causes sufficient trouble. They should be lined with cast iron for coke, although for coal steel liners are adequate.

Wherever possible, a conveyor discharge should be received in a pocket chute, which is nothing more than a horizontal shelf upon which the coke piles up until it holds as much as possible. After this, coke slides over coke, that in the pocket forming a cushion which receives the impact of the discharge. Long chutes should also have a similar anti-breakage buffer to reduce breeze and prevent the wear due to impact.

FIG. 15: ZIG-ZAG CHUTE

To lower coke vertically without undue breakage, a zig-zag chute is used, as shown by Fig. 15. It consists of a system of horizontal shelves, filled with coke dirt. The action of the dirt is to prevent wear on the chute and reduce coke breakage. When coke reaches the pile it automatically escapes out of the side of the chute without the use of gates or movable parts. Breakage is reduced because the velocity and the inertia of falling coke is a minimum and impact is on soft dirt. This device has been in use for many years to lower anthracite coal in retail yards, where breakage is a serious factor.

Chutes on the sides of or under bunkers for loading wagons, should have perforated bottoms to give a final cleaning before shipment. They should be wide and shallow to give a large screening surface. The breeze hoppers under these screen chutes should be large enough to avoid having to empty them frequently.

## Bunkers

The practice has been to build steel bunkers for coke storage subsequent to shipment, without regard to the possibilities of any other type of construction. The first all reinforced-concrete coke bunker built for a large gas company is shown by Fig. 16, being at the works of the Camden Coke Company, Camden, N. J. Since its construction many more have been built of concrete. The advantages are the longevity of the material, the ability to resist abrasion, especially when protected by a surface hardener, and the absolute rigidity of the structure when well designed.

At Lynn, Mass., a reinforced-concrete bunker supports a balanced vibrating screen and there is no vibration whatever in the structure. Here, the concrete side walls and partitions were carried up to the screen floor and the entire top covered by a 6-in concrete floor, except for the opening under the screen. Of course, if the concrete had been stopped just above the point where the flow of coke touched the walls, and the steel superstructure started here, and if this steel superstructure had been used to support the screen, there would have been vibration aplenty. This is only one of the thousand and one points which must be borne in mind when designing (or buying) a coke handling and storage plant.

## Other Types of Bunkers

Other types of bunkers have been built, such as with steel columns and beams up to the floor, a concrete floor, and walls either of steel, concrete, wood, or a combination of both. Wood should be avoided due to the fire hazard. For smaller plants, steel plate bunkers, lined with 2 or 3 in. of concrete put on as plaster give excellent service, but any possible vibration should be given consideration.

If a steel bunker with a hoppered bottom is used, the plates around the outlet will rapidly wear out by abrasion, because the entire coke contained in the bunker must pass through this opening and scrub on a few square feet of plate in so doing. It must, therefore, be protected by some suitable system of easily renewable liners.

## Ground Storage

Perhaps the commonest method used to store coke on the ground is to have a barrow trestle from the screened coke bunker. This works in with the platform elevation when this is used to elevate the coke.

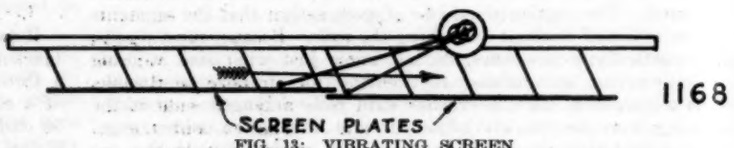


FIG. 13: VIBRATING SCREEN

It is only common because it was installed in many plants before modern conveyors and cranes were developed. Recent plants, even though they may use a trestle for ground storage, have a deBrouwer conveyor, a skip hoist, or other machine to elevate the coke to the screens. After the space below the trestle has been filled, the coke may be stocked out by a locomotive crane operating a grab bucket. When reclaiming, the crane fills a car having a capacity of say 20 tons. This must then be pushed to the elevating system and emptied by gravity, or the car must have a flat bottom, so that crane can dig it out.

If, instead of using a barrow trestle, we use a belt conveyor to deliver coke to the stocking out pile, we will greatly increase the capacity without increasing the labor cost. Of course, in a plant where one man can wheel out all the coke sent to ground storage, it would not pay to put in the conveyor, as no labor would be saved, the man's duties merely changing.

However, assuming the installation is justified, the conveyor discharges to the ground by means of a traveling tripper. The crane digs from this pile and stocks out to the limit of its reach. The crane tracks are on each side of the conveyor runway, so that the pile, which was seven or eight tons per running foot, may be stocked out by the crane until it is about 100 tons per foot. To reclaim, the crane delivers to a travelling hopper or to any one of several fixed hoppers located over the belt and at such points that the crane is always within easy reach of one of them. The conveyor must be reversible.

A telpher system for handling the ground storage works is very well because it handles coke to the screens also. Every operation is accomplished by means of one machine and one man, and aside from the labor saving, we all recognize that simplicity should be the keynote of the design of a conveying system.

Again, the fragile end of our three sided product is treated better by the telpher than by many other systems. It will not only hoist but will transport, with one handling, the resulting saving in breakage due to the elimination of the discharge between the usual hoisting device and the conveyor, probably being sufficient to justify the installation of the outfit, regardless of the saving in labor effected. Other advantages of the telpher were given in a previous paragraph. One possible disadvantage is that the system has not a large capacity compared with others. This objection, however, only applies to very large plants.

Occasionally, one sees a pivoted bucket carrier encircling a coke storage pile, but this device will not stand a close scrutiny under the O. M. I. A. (operating - maintenance - interest-adaptability) microscope.

The deBrouwer conveyor can store coke under the incline run to the screens if this space is available, but it should not be used as a ground storage conveyor because it is designed to perform other functions and to use it for merely one of them robs it of many of its advantages.

Another method of handling the ground coke is by means of a travelling bridge or gantry crane but this costs entirely too much for the labor saved. Several other machines will do the same work at a much lower first cost and with smaller carrying charges.

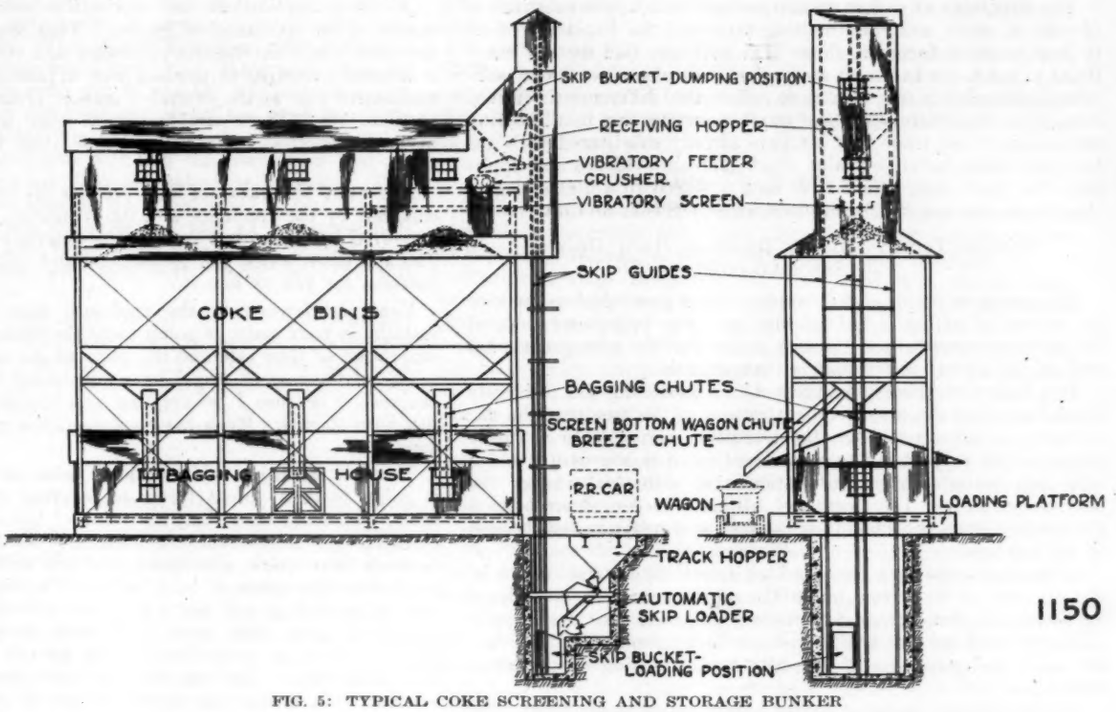


FIG. 5: TYPICAL COKE SCREENING AND STORAGE BUNKER

### Labor Saving

A few words regarding labor saving may not be amiss. All financial and industrial authorities unite in agreeing that any machinery investment is justified if the carrying charges eliminate an equal amount of labor, for labor saving is not merely a question of actual money saved. The advantage lies also in having your product handled mechanically and being forever independent of uncertain labor conditions, strikes, or shortage of men.

A good rule is, $1.00 per day saved in labor justifies the expense of $2,000 to $2,500 for labor saving equipment. Thus:

| | | |
|---|---|---|
| Assuming machinery and structure, etc. | $13,000 | |
| Assuming foundations, etc. | 2,000 | |
| | | 15,000 |
| Labor (one man) | | 600 |
| $15,000 @ 6 per cent interest | | 900 |
| Power consumption 300 days @ 75 cents | | 225 |
| Maintenance and depreciation: | | |
| Machinery $2,000 @ 12 per cent | | 240 |
| Structure $11,000 @ 5 per cent | | 550 |
| Yearly carrying charges | | $2,515 |

$2,515 ÷ 365 = $6.90 daily carrying charge for $15,000 invested = $1.00 for $2,200 invested. This will vary and depends on the power consumed and whether one man can operate the machinery.

Note that the depreciation of machinery is 2 per cent higher than is usual for conveying machinery and that for the structures, which includes the cost of excavations, foundations, all steelwork, etc., it is taken at 5 per cent, which is 3 per cent higher than usual. What must be remembered is that the determining factor is not the probable life but the probable usefulness of a machine. It is pretty safe to say that in twenty years a machine will be obsolete and will then be replaced by other equipment. Theoretically, the installation of the second equipment should be charged with the burden of the remaining years of the life of the original installation, but in the above example this has not been done, for the writer believes that the figures used are just about right.

The illustrations and cuts used in this article are descriptive of plants equipped by the R. H. Beaumont Company, of Philadelphia.

## Value of Gas Not Determined by Competitive Cost of Other Fuels, but by Its Degree of Usefulness

**This Affects Fuel and Operating Efficiency, Labor Costs, Quality of Product, Investment, Production, Etc.—Intensive Application to Problems that Arise Bring Best Results in Industrial Fuel Field**

To a small or large extent, every heating operation has been successfully carried on with gas in some locality or other. In other words, every heating operation, no matter how complex it may appear, no matter how high or low the temperature of operation, can be carried on with gas fuel, declared Henry O. Loebell, of the H. L. Doherty Company of New York City in his paper on "Industrial Fuel Gas," presented at the annual convention of the National Commercial Gas Association at Atlantic City.

Each city, with its old or new established industries, offers distinct problems to the gas man; fundamentally they are about the same. You can sell your commodity in competition with any other commodity provided that yours has some advantage over the others. It is not necessary that the advantage be in cost; but it must be an item of sufficient importance to make the use of your commodity more desirable than the other.

From a heating standpoint alone, we can never hope to be able to produce artificial gas cheaper than the cost of natural fuel from which gas is made. The reason for this is obvious. The cost of gassification, distribution, etc., must add to the original cost of fuel and, outside of the possible chances of selling the by-products at a high price, gas will always be higher in price, per unit of heating energy, than natural fuel.

The work of gaining the necessary advantage with gas over other fuels must be accomplished through proper merchandising, proper engineering and proper appliances.

The value of gas is not determined by the competitive cost of other fuels, but by its degree of usefulness. There is no human being capable of visualizing a thousand cubic feet of gas and determining its value. Its use is the only determining factor of its value and the greater the degree of its usefulness, naturally the greater its value.

Usefulness affects not only fuel and operating efficiency, but affects labor costs, quality of product, investment, production, etc., and to those items we must look to secure credits that not only overbalance fuel costs but give gas preference and permanency.

The displacing of coal in restaurants and hotels; the substitution of coke in candy and brass melting furnaces; the displacing of oil in heat treating furnaces, shows that with gas fuel costing many times as much per heat unit as the fuel it displaces, we found sufficient counterbalancing factors to offset the difference in initial cost. This condition holds good in all industries and in all heating applications; but those that we have already substituted with gas have had these factors of value much more in evidence and appliances for these applications have been devloped to a higher degree than those that are still being fired with coal, coke and oil.

### Selling Industrial Gas Requires High Degree of Specialization

The management of a gas company has a great deal to do with the success of selling industrial fuel gas. The policy and scope of the industry depends upon the wide vision that the management has and on the liberal policy that is inaugurated.

The degree of interest manifested in wholesaling gas is largely dependent upon the manager's realization of the fact that the gas company is passing through the transition period from a purely public utility corporation to a combination of public utility and a wholesale manufacturing institution that sells fuel energy for heating purposes. The degree of ultimate success depends to a great extent upon the amount of interest he displays in that branch of the business.

Selling industrial gas requires high specialization and cannot be classed with or be carried on in the same manner as the sale of appliances for domestic or illuminating purposes. Intensive application to problems that arise will bring better results, but you cannot apply the principles of specialty merchandising to any great extent.

The average gas salesman to-day is in want of inspiration. The manager of a gas company is the logical man to continually supply the spark that kindles the enthusiasm of the men on the firing line. He must supply the men with incentive and picture to them the wonderful possibilities that the industry has.

### An Epoch of Service

This is an epoch of service. Gas service is daily extending its scope, and the faith and confidence we can instill in the men will not only be directly reflected upon their ability to secure business, but will inspire them and make them realize that the gas industry offers sufficient reward and possibility for advancement to make it their life work.

The salesman, or engineer, as you may choose to call him, upon whom you depend to get industrial fuel business, must fulfill a great number of qualifications. I do not know of a school or college that can produce good industrial fuel men, nor do I know of any man who made a great success unless he possessed both engineering and selling ability. It is hard to say which branch is easier to acquire—salesmanship or engineering. I am inclined to believe the latter. It is probably easier to train a good salesman to become a good engineer than it is to train a good engineer to become a good salesman.

However, even with those two qualifications, the industrial man is not equipped completely, but must also have constructive imagination. He must be able to analyze economic and labor conditions and detect weaknesses in present systems of manufacture where heat is used, and be able to picture a system where he can capitalize the substitution of gas.

An industrial fuel man must be practical in his recommendations and must also have originality to conceive new adaptations that will benefit the customer as well as the company. He must have your confidence and command esteem from your customer.

It may be that I am trying to picture a composite personality such as mortals cannot achieve. But we have them to-day and other industries have produced a great number of them. They are products of aptitude and application, developed in an atmosphere of inspiration for the accomplishment of big things. They must be well paid so that their personal comforts do not worry them and they must have an incentive supplied for their future.

### The Means at Hand

The appliances and applications of industrial gas are too numerous to list and discuss in detail. They cover the utilization of gas from the smallest burner using a fraction of a foot of gas per hour, to burners using thousands of feet per hour; from the heat necessary to increase the temperature 1 deg. over atmospheric temperature to temperatures close to the maximum flame temperature of gas.

All these applications and utilizations must be carried out by means of an appliance or burner. They do not always embody the most desirable features of design and construction, but there is a great incentive to produce new appliances and correct those weaknesses due to the extended market created by industrial expansion, etc. Those are the items that will eventually count more in securing industrial business than the cost of the fuel itself.

Moreover, the value of our product is not determined by its cost, but by the appliance and its utilization. The gas we sell is measured by meter, but its value is determined by the appliance. The appliance which you recommend and sell will either hold the business for you or lose it.

Your indifference to the appliance your customer buys and installs on your main, is going to be the determining factor in his conception of your rate and the value of gas as a fuel.

One of the reasons why I have unbounded confidence in the gas business is because I believe that gas appliance development has just been started. Much has been done, but more can and will be done.

There is an aspect of the added value of gas utilization that is going to be a potent factor in securing business—the cost of labor, and, more than that, the value of labor is increasing daily. Creating appliances that are automatic in operation and which decrease labor costs, appliances that are well insulated and give comfort to the operator, leads to better working conditions, lower cost of production and has a tendency to retain labor for greater periods of time. Still another economic factor that will add its power to force gas to the front is the present tendency of intensified production. Gas adapts itself to intensive operation and wherever heat is used gas should be able to gain favor.

### Rates

Rates for industrial gas have been the subject of discussion for a great number of years, but not until recently have such changes been made by some gas companies as to justify the thought that they are giving this matter serious consideration.

It is not within the province of this paper to suggest a scheme of rate making that fits industrial business specifically, but it may not be out of place to point out the fact that rates for industrial fuel or wholesale rates must eliminate competition of isolated gas plants that may be established in large manufacturing institutions to supply their own needs.

In other words, it is not sufficient for the gas industry to develop appliances and applications for the efficient use of gas and successfully displace other fuel. It is just as essential after securing the business or convincing the manufacturer that gas is the most desirable fuel, to avoid installation of an isolated gas plant.

There are a great number of other phases to this end of the business that embody the complete change of the established methods of producing gas, but they are out of the province of this paper, although they have a bearing on the development of industrial gas business.

The reason why gas companies have not established differential rates for large customers is due to the fact that a great deal of the wholesale business the gas companies have to-day, is at retail rates, or slightly below, and they cannot afford to lose the revenue derived therefrom by reducing the rates to a point where it would make it possible to secure a great deal more industrial business.

The condition, however, is adjusting itself, and daily we see more companies coming to the front, absorbing the loss of revenue, and forcing the new business to take care of it.

I believe that this fact is known by every gas manager, but, due to lack of courage to risk what appears to be cash in the till, for the ethereal possibility of new business, progress is necessarily slow. But with the development of new and efficient appliances the field for new business will be so much greater that the small percent lost in adjusting the rates will be insignificant.

### Psychological Effect of Low Rate Greater Than Its Real Value

The psychological effect of a low rate is much greater than its real value; a low rate may attract a prospective customer, but the appliance determines whether the cost of production is lowered or raised.

There are cases on record where extremely low rates have been made and the business secured, but the appliances were not as efficient as they should be and the rate did not help much.

The fuel used for heating operations, such as secondary heating, melting of non-ferrous metals, etc., is largely fuel oil, some coke and coal and a little gas. The fuel used in food-stuff industries is largely coal, with some wood and gas. Here and there an isolated plant making its own gas brings the warning of a new competitor; and last, but not least, electricity has come to invade the field with its fascinating possibilities.

Elsewhere in this paper you will find the contention that we cannot compete with primary fuel on heating value basis. This competition will exist as long as we are satisfied to build appliances that do not eliminate the objections that all fuel appliances have. We must create new value in the use of gas, separate and apart from its fuel value, and then with proper rates we will dominate the field.

Notwithstanding the fact that the use of fuel oil is almost general in the metallurgical industries, the last two years have given its users some very unusual sensations, increases in prices, lack of delivery, etc. Fuel oil is not a permanent fuel and those who argue to the contrary should go over the conditions in the fuel oil market for the first six months of 1916.

### Fuel Oil Appliances Can Be Displaced on Cost of Operation Basis

Apart from that, the efficiency of fuel oil appliances is so low that it would require little effort to successfully displace them on cost of operation basis, but the difficulty is, we have no gas appliance that will do the work right. In a number of cities, gas is sold as cheaply as oil on a heating value basis, but the gas cannot be sold because of lack of gas appliances.

It may be of interest to note that fuel oil is much more expensive than coal or coke, and that the work now done with fuel oil was formerly done with solid fuel. But the advantages gained by using oil seperate from its fuel value have made its use universal for certain purposes.

Electricity, as a competitor, is much more serious in my estimation than oil or solid fuel. Electrical men have no established method in converting gas using appliances to electric. They create new devices that eliminate the difficulties present in fuel appliances and, much as I dislike to say it, we ought to take the hint from them.

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## Explains How Combustion of Explosive Mixtures is Made Both Possible and Desirable

**L. J. Platt Discusses Recently Perfected Mixing Devices Which Create Homogeneous Explosive Mixtures of Air and Gas in Their Chemically Perfectly-Proportioned Amount and Eliminate Excess Air**

Explosive mixtures are called self-propagating; that is, if ignition occurs at any point within the mixture, combustion will proceed from that point to the adjacent point, as no additional air is required for combustion, explained L. J. Platt, in his paper on "The Correct Utilization of Heat," presented at the recent annual convention of the National Commercial Gas Association. The combustion will spread from the point of ignition in all directions and at a rate known as the rate of flame propagation.

In an explosive mixture the rate of flame propagation depends upon the composition, temperature and pressure of the mixture.

The first item need only be considered when different gases or oil are to be used; as, for example, the rate of flame propagation in natural gas or oil gas mixtures is much lower than it is for mixtures of carbureted water gas and air, which, in turn, is much lower than that of a mixture of hydrogen and oxygen.

In a given explosive mixture the rate of flame propagation increases with an increase of temperature and increase of pressure.

### Combustion of Ordinary Mixtures of Air and Gas Takes Place on a Surface of Finite Thickness

Considering, again, a mass of explosive mixture with ignition occurring at some point, the flame will travel from that point in all directions and at the same rate and will, therefore, be spherical in shape.

The surface of the sphere will be a flame which separates the unburned mixture of the mass from the burned mixture inside the sphere.

Hence this conception of combustion presupposes that there is always a surface of flame dividing the burned from the unburned mixture.

A surface, strictly speaking, has no thickness and combustion could only take place on such a surface if we assumed the mixture to be made up of perfect and undiluted gases. The combustion of ordinary mixtures of air and gas takes place on a surface of finite thickness.

### How Burning Takes Place

Having considered the combustion of explosive mixtures from a purely hypothetical standpoint, let us see how the combustion of explosive mixtures is made both possible and desirable.

Mixing devices have recently been perfected which create homogeneous explosive mixtures of air and gas in their chemically perfectly proportioned amounts, eliminating excess air.

Exactly how the burning takes place in the system employing one such device, has been a matter of dispute, but the explanation given by Dr. C. E. Lucke of Columbia University is the most readily comprehensible and satisfactory and coincides with the conception of flame propagation considered above. He considers the process a simple burning of the mixture at a point depending on the speed with which this mixture travels and its velocity of flame propagation.

Clearly, there are three conditions possible with these quantities:

(1) Where the mixture moves faster in one direction than the flame burns back in the opposite direction, as in the effect often seen on blast burners of the flame "blowing off."

(2) Where the mixture moves in one direction at the same rate that the flame burns back in the opposite direction, a condition seen when the ordinary Bunsen burner is working properly.

(3) Where the flame travels back faster than the mixture moves forward, as when we have a backfire in a Bunsen burner.

### Problems Involved

There are two problems involved in the combustion of the gas by this method.

Since the system deals with explosive mixtures, great precautions must be taken to prevent backfire. The problem is one of preventing the flame from reaching a wrong point.

This is done by making the forward speed of the mixture greater than the backward rate of flame travel at the position beyond which it must not travel to prevent backfiring; i. e., at the nozzle of the burner.

The second problem is to localize the heat by reducing the speed of the mixture until it equals the speed of the flame at the place where it is desired to generate the heat. The last result can be effected by placing a baffle in the path of the jet of mixture, consisting of a bed of refractory pieces.

The gases are slowed down in the interstices between the pieces where ignition occurs, and, due to the fact that explosive mixtures burn at very great speed once they are raised to their ignition temperature, the amount of fuel that can be burned in a given space is greater than by any other combustion process.

The localizing of the flame in the refractory bed results in temperatures being produced in this bed that are very close to the theoretical flame temperature of the fuel in question. (For a certain carbureted water gas of 650 B. t. u.'s per cubic foot, this calculated flame temperature is 3,500 deg. Fahr.) Consequently the bed is intensely radiant.

---

## Commercial Manager of Gas Company Should Be Above Personal Likes and Dislikes

No manager should permit hemself to be prejudiced by the personality of the person representing the manufacturer as salesman. We all realize that this is about as difficult to carry out as is the eleventh commandment. The fact that a salesman by his actions or his voice or some little mannerism may be distasteful to the manager is no justification for the manager's refusing to consider the salesman's line. It must be admitted, however, that frequently the personality of a salesman is so annoying to a buyer that he permits his judgment to become warped and he refuses to take up that particular line. Any man, and herein lies the heaviest responsibility of the commercial manager, big enough to be manager of the commercial end of a gas company ought to be big enough to rise above this very human failing and eliminate personal likes and dislikes.—*Extract from composite paper of Manufacturers' Section of National Commercial Gas Association.*

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## Developing Friendship

Sooner or later, during the existence of any public utility company, there comes a time when the active friendship and interest of the community it serves becomes an invaluable asset. It may desire some beneficial legislation, it may be some change or extension to its franchise, the keeping out of a competitor who seeks only to destroy what has already been built without any desire to permanently better the conditions within that community, a change in the system of regulation in standards, etc. In any of these cases the obtaining of its desire would be a foregone conclusion if the company possessed the friendship, the confidence and the good will of its community.

But how is this to be accomplished? The question has already been answered effectively in hundreds of cases. The problem is the most simple in solution, perhaps of any we have before us to-day. The general public is about the most responsive body to efforts made to influence its judgment of any in existence. Publicity is doubtless the best answer.

The Journal believes that constant, semi-indirect publicity will prove the best and, in the end, most economical form of any. Some companies have utilized this means temporarily to accomplish an individual result with a remarkable degree of success. But if it is resorted to too often it is likely to react against itself.

If the average gas company merely kept its patrons constantly informed of the efforts it is making in their behalf, the AMERICAN GAS LIGHT JOURNAL is firmly convinced that it would gain the friendship of practically the entire community, for the modern gas company is being run on the service idea. It is meeting the public half way and constantly seeking to go the rest of the distance. The public is appreciative. If it knew this it would respond quickly, enthusiastically and lastingly.

The gas company should tell people about itself, of the good it is doing in the community—should see to it that it received its proper need of praise.

Falsehood or exaggeration is unnecessary. The average gas company is doing enough for its patrons to entitle it to their appreciation.

## The City Beautiful

Occasionally, there creeps into the columns of the daily press some absurdity so apparently founded on ignorance as to cause one to believe for an instant that we have not yet gotten beyond the stage coach and canal days of travel. Such an article appears in the Dec. 2 issue of the *Boston Transcript*.

The "Listener," in discussing New York conditions, informs us in all due solemnity that it seems "absurd to spend millions of dollars in the beautifying of a great city with ornamental parkstrips, viaducts, and embankments, and then leave upon the Riverside Drive, for example, a great bulging, beetling, boiler-plate mass, *painted a blatant vermillion*, too, thrusting its ugly bulk into the place of key to the whole scene."

Oh, Boston! where are your travellers? Can it be possible that the too often overcrowded trains we see rolling in from that direction contain only New York people returning from trips there, or can it be that the writer had seen the tank in question many, many years ago and has since passed it several times without its obtruding itself upon his notice, due to the measures that have since been taken to render it less conspicuous? If the latter is the case, then the aforementioned remark resolves itself into about the finest tribute paid to the efforts of a gas company in its public-spirited attempt to fit in with the ideas of its city's authorities in their endeavors towards a city beautiful, that has come to the attention of this journal for some time.

For the benefit, not of Bostonians, for we still believe that a very large proportion of them are tolerably familiar with New York conditions, but for the benefit of those who are as many days' distant as Boston is hours, we will state that the "bulging, beetling, boiler-plate" mass in question is not, and has not been for many years painted in a blatant vermillion, but in a meekly unobstrusive silver hue. The "Listener" states further that "a gas tank cannot assimilate with anything at all." It is our impression that the present appearance of this holder is the result

of a co-operative effort of the gas company and the city park authorities to accomplish just such assimilation, and that the degree of success attained is a source of considerable gratification to all concerned.

The best thing that this journal can wish for the "Listener" of the *Boston Transcript* is that but few of the people of Boston read his column. If such is the case, his absurdity may pass unnoticed. Otherwise, the result is apt to destroy the confidence of many in the quality of the publication which employs him. The days when the life-long and continuous resident of Bryn Mawr could write stories descriptive of the "Wild West" and be taken seriously have long since passed. People know too much nowadays, and travel too extensively.

We do not agree with the "Listener" in regard to the appearance of this particular gas holder but we will agree that if their appearance in a city "are part of the *price* of modern conveniences and improvements, modern communities must pay," as he states, that the communities are getting them very cheaply at that. In our opinion—doubtless biased and distorted—the saving of a half-hour's work in the daily existence of a million women outweighs in importance any aesthetic shock those few, who might encounter one of these so-called "bulging, beetling, boiler-plate masses" might sustain.

## The Trend Towards Gaseous Fuels

As the cost of both labor and fuel increases it is interesting to watch the trend away from solid fuels and towards liquid or gaseous fuels. For some time the use of pulverized coal instead of coarse coal has been more or less common in work where the whole surface of the fire box can be maintained at a temperature above the combustion point of this form of coal. Its use under boilers was at first impractical on account of the temperature of the water tubes being so low that the combustion of particles coming into contact with them could not be maintained, due to the sudden lowering of their temperature. Special fire boxes, therefore, had to be designed and the experimental work on these consumed a considerable amount of both time and money. Now, however, we find powdered coal used for firing both stationary and locomotive boilers. Its further adoption seems certain.

Perhaps the best way to show how this is a trend towards gaseous fuels is to give the gist of a few of the reasons why pulverized fuel should be used for locomotives that John E. Muhlfeld gives in his paper presented before the Annual Meeting of the American Society of Mechanical Engineers. The substance of some of these reasons are as follows:

One fourth to one third of the expenditure for locomotive fuel for the steam railways in the United States represents the proportion that is expended to kindle, prepare, clean and maintain fires on grates when locomotives are standing, drifting or otherwise not actually using steam to move themselves, either light or with trains.

Changes in the domestic and foreign supply and demand, as well as in the regulations, methods and labor governing mining operations, cause a progressive increase in the price per ton of fuel.

In order to provide the maximum draw-bar horsepower per hour, the steam locomotive must be so improved as to secure continuity of working pressure, greater sustained boiler capacity, increased boiler efficiency, reduced cylinder back pressure, and more highly super-heated steam, all of which can be produced by the use of pulverized coal.

The large quantity of steam required by the modern locomotive necessitates excessive rates of evaporation, such as can only be effectively and economically produced by the burning of pulverized fuel in suspension in order to utilize the heat units that now go out the stack and into the ash-pan when solid fuel is fired on grates.

By mechanically feeding and burning pulverized fuel, arduous labor on the part of the fireman, such as is now required to shovel ahead and supply coarse coal to grates and to rake and clean fires and ash pans, is replaced by more skilled manual control of combustion and assistance to the engineer in the operation of the locomotive and observation of track and signals.

As the cylinder horsepower available is entirely dependent upon the boiler horsepower and temperature of superheated steam produced, the use of pulverized fuel to increase the heat value per cubic foot of fire box volume and provide a higher average and more uniform fire box temperature in combination with a reduced front-end or waste-heat temperature, appears to be the most logical means for the solution of the problem.

These arguments should be of interest to the industrial gas salesman. What is said in favor of pulverized coal has a double meaning when gas is applied. The trend is away from solid fuels. It is to the interest of the gas industry and in the interest of conservation to hasten its progress.

## Belittling the Merits of a Competitor

From at least one criticism those outsiders who have essayed to tell us a great deal about the gas business and how to run it have spared us. In no general sense have they accused us of dwelling unfairly upon the disadvantages of competing sources of light and heat. Whatever efforts have been made along such lines have been from the service standpoint alone.

One high up in the gas industry takes particular pride in asserting that throughout his career he has never pushed gas for a purpose where another source of energy would be preferable. Yet this man has been exceptionally successful in extending the use of gas, and the companies he has been connected with have been constantly, even rapidly, extending their business. In his individual history, there is contained the most convincing proof of the fallacy of playing upon a minor disadvantage of one source of energy to affect a temporary increase in the sales of another, and his history in a general sense is typical of the history of the entire gas industry.

Senseless bickerings will accomplish no good to anyone. In fact, they may do a great deal of harm. The great competitors in the lighting field are electricity and gas. The electrical man can unquestionably, by dint of painstaking research, find many disadvantages in gas for lighting that will have sufficient basis, in fact to furnish an argument that will tend to influence the mind of a layman. Subjected to scientific analysis, very few of them would hold water for an instant. Yet unless they can survive this latter test, no man who has the best interests of the electric industry at heart should be guilty of making use of them to effect a sale.

Likewise, the gas man can find many disadvantages in electric lighting. Some weeks ago, for example, there was published in these columns the results of an investigation that proved conclusively that electricity, from the standpoint of fire hazard, is more than twice as dangerous as gas. It is quite conceivable that some salesman might make use of this as a strong argument against electric lighting. As a matter of fact, the only use that should be made of this information in the way of an argument is in combating the impression that the gas man, through indifference, has permitted to become general, that the ratios are just the reverse.

Fire hazard is an argument that in honesty should have no weight in either case. Modern developments in installation methods have so minimized this factor, that it should not be considered at all, except by the engineers of the respective industries in seeking to so improve even upon present methods as to reduce what is already almost a negligible source of danger to an absolutely negligible one.

The fire hazard argument is about as silly as the "introducing a poisonous gas into our homes" assertion that we sometimes hear from some electrical salesmen, whom the electric industry, we are quite sure, would much rather have eliminated from its ranks than we would.

It is about on a par from the standpoint of intelligence with what a pointing out of the potential danger of canned provisions on the part of hot house producers would be.

Undoubtedly, the eating of such provisions would be dangerous if they were not properly canned. But the canning industry has progressed to the point where the danger is principally conspicuous on account of its absence. Likewise, the introduction of either electricity or gas into a home would be dangerous were they not properly controlled. But just as the canning industry has progressed, so have we progressed.

The unfounded belittling of the product of a competitor has been proved a poor business policy for the concern or individual guilty of the practice, and a source of profit to the competitor it is intended to injure. The journal is glad that it is one that has never been adopted by the gas industry. Unquestionably, this is one of the reasons the latter has progressed to the extent it has.

# No Difference Exists in Principle Between Gas and Electricity in Considering Differential Rates

**J. M. Spitzglass Takes Issue with Those Who Contend That Relative Economy in Providing Gas Storage to Equalize Output of Gas Generators Constitutes a Reason Why Principles Underlying Sliding Scale Rates as Employed in Electrical Industry Do Not Apply to Gas Industry**

There are a few points in the question of the difference assumed to exist between gas and electric rates that may not be fully understood until after the fundamental principles have been considered, declared J. M. Spitzglass, of the Peoples Gas Light & Coke Company of Chicago, in his paper on "Where We Stand in Rate Making for Gas or Electricity," presented at the annual meeting of the Pacific Coast Gas Association. For instance, there is the mistaken idea that the customer's demand should be taxed for the higher cost of production due to variation in the hourly demand during the day, and another idea that the cost of equipment to provide for the probable demand of all the consumers does not fall due on those consumers who did not care to utilize the demand that was provided for them.

In accordance with these ideas, E. N. Strait, voicing the practice of the Wisconsin Railroad Commission, says in his paper read before the Wisconsin Gas Association in 1915: "It is possible to distribute the gas expenses among the consumer, demand and output groups, as was done in analyzing the expenses of the electric department, and this has actually been done for some of the gas cases before the commission. But inasmuch as a satisfactory and practical method of determining and classifying the demands of consumers of gas has not been found, capacity and output expenses are combined and treated as output expenses in making the computations for the rates.

"Fortunately, for this situation, the factor of demand is of less importance in the gas than in the electric business, because the possibility of economically storing gas against the daily periods of greater demand, enables the gas plant to produce uniformly and thereby eliminate the effect of daily variation of demand upon the cost of production. While it is true that variation in the rate of production sometimes occurs in the manufacture of gas, the cause which gives rise to that condition is not inability to meet the variation of demands by means of storage facilities."

### Absurdity of Contention

Does not this sound as though the holders are given gratis to every gas company which builds a gas generator? Is there any difference in the principle whether the equipment provided to take care of the maximum demand consists of holders or variable load generators? It is all a difference in degree and not in kind or principle. If the cost of demand for gas is less in proportion than for electricity, the customer will pay less for it, and there is no reason why it should be charged to the quantity of consumption and thereby prevent the natural development of the business.

I must admit that the commissions in general acknowledge the fact that there is no difference in principle between gas and electricity in considering differential rates. The Wisconsin Railroad Commission says in its "Opinions and Decisions" (Vol. 5, page 29), "The same principle applies to the sale of gas and water, but to a less degree, since both of these products can be stored for a limited time."

In another paper closely related to the Wisconsin Railroad Commission, ("Practical Aspect of the Demand Rate for Gas Service," by J. H. Cook in the Proceedings of the Wisconsin Gas Association, 1915, pages 33-46), the author says that "The lack of progress in the development of a suitable demand rate for gas has not been due to any defect in the theory underlying such a charge, but to several causes, among which may be enumerated: The lack of a suitable method of measuring the customer's demand; inability to determine what are the demand costs of service; the conflict with prevailing systems of charge; lack of appreciation of the prospects for business and, lastly, the very conservative character of gas managements."

Of these five causes, the first two should apply to electricity as well as to gas, while the last three, especially the last two, actually hit the nail on the head.

No better truth could be advanced than to say that the conservative character of gas managements will have to undergo some changes if that industry is to keep pace with their less conservative rivals.

## Report on High Pressure Pumping at Boston Shows Lower Operating Costs for Gas than for Electricity

In response to the recommendation of the Boston Chamber of Commerce in regard to high pressure pumping service at Boston, Mass., Commissioner of Public Works Edward F. Murphy and Joseph A. Rourke, Engineer-in-Charge, have rendered a report to Mayor Curley on the cost of installing and the cost of operating stations of 24,000, 12,000 and 6,500 gallons per minute, under conditions of gas engine and electric motor operation. The report shows that, although a larger total investment would be required for a gas engine station, operating charges would be much less than for an electric station. The comparative figures are as follows:

| Type and Capacity of Station Gals. per min. | | Total Investment | Fixed Charge Per Year | Operating Charge | Total Yearly Charges |
|---|---|---|---|---|---|
| Electric, | 24,000 | $523,658 | $48,513 | $54,000 | $102,513 |
| Gas, | 12,000 | 245,284 | 22,295 | 20,200 | 42,495 |
| Electric, | 12,000 | 202,408 | 18,288 | 30,500 | 48,788 |
| Gas, | 6,500 | 150,994 | 13,428 | 15,910 | 29,328 |

The above figures contemplate, for a 12,000 gal. per min. station, an equipment consisting either of six 300 k.w. motors direct connected to centrifugal pumps of 2,000 gal. per min. capacity, driven by 600-volts direct current; or 6 gas engine units geared to 6 centrifugal pumps. Costs are reckoned at $8,200 for each electric unit, and $17,200 for each gas unit. For a 6,500 gal. gas station, three 425 h.p. gas engines are estimated to cost, with gearing, pumps, etc., $17,200 each, or $51,600. The estimated costs of operation are:

| | Electric Station | Gas Station |
|---|---|---|
| Maintenance of Equipment | $1,000 | $2,000 |
| Electric Standby Service | 12,000 | |
| Electric Current | 3,000 | |
| Gas | | 700 |
| Telephone | 2,500 | 2,500 |
| Station Labor | 12,000 | 15,000 |
| | $30,500 | $20,200 |

In this connection, engineers of the Boston Consolidated Gas Company point out that in Philadelphia two high pressure stations are gas operated, one at Race Street being equipped with seven 300 h.p. and two 125 h.p. gas engines, and the station at Lehigh Street with ten 300 h.p. and one 125 h.p. engines. A pressure of 300 lbs. is available at any part of 25 miles of mains in three minutes. For the 12 years in which the Race Street plant has been installed, repairs have amounted to only $15. The only time there has been any difficulty in connection with operating the Philadelphia plants was when electric wires from outside service supplying ignition were burned off in a great conflagration; but then the operator threw the plant onto its own ignition system, with no halt to the pumps. Thorough reliability, in addition to economy of operation, make the gas people confident of their great advantage over electricity.

## $11,000,000 Corporation Asks Approval of Charter

The Commonwealth Light and Power Company, an $11,000,000 corporation, has applied to the State Tax Commission for approval of its charter. The application was accompanied by a certified check for $2,200 to pay the state bonus tax.

The new company, of which George R. Gaither is the local counsel and H. Granger Gaither resident agent, has New York backing and its charter affords sweeping powers along commercial lines. The charter provides authority for the corporation to purchase, build or otherwise acquire and operate electric light and power works, waterworks, gas plants, and storage and icemaking plants, but under its charter it cannot do business in this state.

A total capital of $11,000,000 is provided—$1,000,000 or 10,000 shares of preferred stock at a par value of $100 per share, and 100,000 shares of common stock at a similar par.

The incorporators of the company are John C. Jackson and Roger Sherman, both of 30 Pine street, New York, and George R. Gaither, of this city. The company is to have nine directors, and those chosen for the first year are George S. Haley, M. B. Webster, Robert Davidson, Thomas R. Crumley, William Howard Hoople, A. E. Fitkin, M. Jones and John Jackson, all of New York, and William C. Harty, of Boston.

# Public Regulation of Coal will Prove Beneficial to the Landowner, Consumer, Mineworker and Operator

**George Otis Smith and C. E. Lesher Discuss Coal Costs and Possible Reductions—Resource Cost Defined—Item of Transportation Perhaps Most Promising from Viewpoint of Lowering Expense**

The price of coal is a matter of vital concern to the average citizen. No less important, however, is the question what our coal actually costs to produce, stated Geo. Otis Smith and C. E. Lesher of the United States Geological Survey, in a paper presented at the American Mining Congress, Nov. 14, from which the following has been abstracted.

The consumption of coal in the United States for heating and cooking is between 1 and 1½ tons per capita. A careful estimate for 1915 is 1.1 tons, which happens to be identical with the figure determined for similar consumption in Great Britain in 1898. This non-industrial consumption is greatest in cities and in the city of Chicago in 1912 it was nearly 2 tons. Of course, every citizen indirectly pays for his share of the total consumption which last year amounted to 4.6 tons per capita.

Looking backward as well as forward, one need not be an alarmist to suggest that in the whole field of productive business the coal industry seems the one most likely to be threatened with government operation. The foodstuffs are produced on land owned and operated by the millions, and so far as the production of the raw material for them is concerned, "monopoly" is an unknown word, but when we think of coal, terms like "barons" and "trusts" instinctively come to mind. For these reasons the determination of certain facts connected with coal production and the analysis of the cost elements that enter into the price of coal constitutes a timely subject for discussion.

## Four General Items of Cost Must Be Considered

In discussing costs, four general items of cost must be considered as normally controlling the price of coal to the consumer—resource cost, mining cost, transportation cost, and marketing cost. Under usual conditions each of these items includes a margin of profit which may seem either excessive or inadequate, according to your point of view. Yet an unbiased consideration of these cost items is absolutely essential as a preliminary to the decision by the public whether we are buying coal at a fair price, and if not why not. As long as it is the popular view that the price of coal is made up of one part each of mining costs and freight costs to two parts each of operator's profits and railroad dividends, with the cost of a certain amount of needless waste on the side, the demand for investigation will continue, and in so far as there is any element of truth in this view, legislative action is justified, even though the prescribed reform may approach the extreme of public ownership and operation of mines and railroads.

As the initial item of cost, the amount charged against the marketed product as the value of the coal in the ground, which for brevity may be termed the resource cost, is perhaps the item most often overlooked by the coal consumer, and for this reason that phase of the subject will be fully considered after the other items are treated. These other items need less discussion in this paper for several reasons: the item of marketing cost is one than can be brought directly under observation by the consumer if he will but study the matter intelligently, the transportation cost can be learned by simple inquiry and its control lies within the province of the Interstate Commerce Commission, and the details of mining cost can best be set forth by the mine operators themselves, for they have now adopted the policy of free discussion of these matters, which they once regarded as sacred from public view. The purpose of this paper, then, is simply to give a summary statement of all the elements in the cost of coal, and some special discussion of the resource cost.

The item of cost first to be considered represents that part of the value given to the ton of coal by the mine operator and the mine worker. This may be termed mining cost, but it must include the operator's selling costs and other overhead expenses as well as the mining costs proper which include the larger expenditures for wages, supplies, and power. This cost plus the resource cost—the royalty or depletion charge—and the profit or loss on the sale make up the value at the mine mouth. The mining cost varies not only between mines of different companies in separated fields but even between adjacent mines of the same company in the same field.

It is not practicable to assign a very exact figure to the mining cost—the census of 1909 indicated an average of $1 a ton for bituminous coal and $1.86 for anthracite, but these figures are believed by some operators to be too low. It is possible, however, to show in a general way the distribution of this item; the cost of mining is divided between labor, 70 to 75 per cent; materials, 16 to 20 per cent; general expense at mine and office and insurance, 2 to 4 per cent; taxes, less than 1 per cent to 3 per cent for bituminous coal, and 3 to 7 per cent for anthracite; selling expenses, nothing to 5 per cent, and recently to these items has been added the direct and indirect cost of workman's compensation which may reach 5 per cent for bituminous coal. The charges for labor, material, and general office expenses are easily understood, as is also a charge for depreciation of plant and machinery; but taxes and selling expenses are important items that may be overlooked by the casual observer. Some figures recently published show that the taxes levied in West Virginia last year on coal lands and coal-mine improvements—that is, on the industry as a whole—were equivalent to nearly 3 cents per net ton of coal produced, which is doubtless fully as much as the profit made by many of the operators in that State.

The cost of selling coal is nothing for the companies that use their own product, including the Steel Corporation and a large number of others, and is little or nothing for the producers who sell nearly all their coal to such large consumers as the railroads. Companies that produce coal for domestic use and the general run of steam trade must figure on a selling cost as high as 10 cents or more per ton, the cost depending on the extent of their business. The average selling cost for bituminous coal is probably 5 to 10 cents a ton, and for anthracite the usual charge of sales agencies is reported as 10 cents a ton for steam sizes and 15 cents for the prepared sizes.

## Costs Through Transportation

To help toward a realization of the magnitude of the transportation item, it may be pointed out, first, that all but 14 per cent of the output of the country's coal mines, aggregating 532 million tons, is moved to market by rail or water, and second, that nearly half of the bituminous coal (47 per cent in 1915) and more than two-thirds of the anthracite (71 per cent in 1915) is shipped outside of the States in which it is produced.

Add to this statement of the extent to which coal enters interstate commerce a glance at the distribution of centers of maximum production and maximum consumption—the New York-Baltimore industrial zone, which has a total per capita consumption of nearly 10 tons and lies 100 to 400 miles from the tributary coal fields; New England, consuming about 7 tons to the unit of population and lying 400 to 800 miles from its coal supply; or the populous industrial district of which Chicago is the commercial center, consuming 8 to 9 tons per capita of coal in part hauled more than 400 miles from the fields of West Virginia and eastern Kentucky and in part 200 miles or less from the Illinois mines. With these facts in mind we must realize that the transportation cost is necessarily a large part of the country's fuel bill.

As has already been suggested, the transportation rate in force from any coal field to any market can readily be learned by the consumer who wishes to figure this item in the cost of the coal he buys. Therefore in the present general consideration of the subject it is sufficient to state the average value of this item. In the interstate traffic, both rail and water, bituminous coal probably pays an average freight of nearly $2 per ton. In other words, the transportation costs more than the product and, as some parts

of the country are just now learning, is sometimes more difficult to obtain. The value of coal like the value of so many other commodities, is a place value.

The average freight charge on anthracite is higher than that on bituminous coal, first, because the rates are higher, and, second, because according to the reports of the Interstate Commerce Commission, *all* movement considered, the coal is carried a greater distance.

### Marketing Costs

The cost of handling the coal, exclusive of freight, from the time it leaves the producer until it is in the consumer's fuel bin, may be termed the marketing cost. It can readily be seen that a large part of the coal produced is not subject to this cost for most large users of steam coal, such as the railroads and the coke manufacturers, place contracts directly with the producing companies or their selling agencies and buy in the open market only when their needs exceed the deliveries under their contracts. Much of the coal, however, both anthracite and bituminous, passes through the hands of a wholesale dealer or jobber before it is received by the retail dealer who puts it in our cellars or in the bins of a power plant. Coal that gets a long way from the mine may pass through many hands before it reaches the consumer, and it not only pays commissions all along the line but is subject to shrinkage and deterioration, both of which enter into the final selling price to the consumer. Brokers are usually satisfied to make a gross profit of perhaps 10 cents a ton, but as several brokers may make a "turn over" on the same car before it is unloaded this element of cost may be several times that amount.

About half of the anthracite and around 15 per cent of the bituminous coal is retailed in less than carload lots, and the greatest number of individuals are directly concerned in the marketing of this portion, regarding the profits on which there is the widest divergence of opinion. The margin in the retail business between cost on cars and price delivered is between $1.25 and $2 a ton and is not more than enough to give on the average a fair profit. The shrinkage and, in part, the deterioration are together seldom less than 1 per cent of the weight and may exceed 4 per cent, and the retail dealer also must provide in his selling price for uncollectible accounts.

Advertising is a large expense—in part carried by the retailer directly but all borne by the industry. The largest single item in the cost of retailing is, of course, that representing the labor of handling and the local cartage, which together make up about half the marketing cost.

### The Major Item—Resource Cost

There now remains to be considered the first major item, or the resource cost, which is what the operator has to pay for the coal in the ground—the idle resource, which he starts on its career of usefulness. This cost is expressed as a royalty or a depletion charge. One of the latest leases by a large coal-land owner provides for the payment of 27 per cent of the selling price of the coal at the breaker. This percentage is therefore not only a royalty figured on the mineral resource but also a commission based on the miner's wage. To bring this right home to you and to me, it may be said that the practical result is that if the anthracite we burn in our range this winter happens to come from that particular property, we will pay fully $1 a ton into the treasury of the city trust that owes its existence to the far-seeing business sense of a hard-headed citizen of Philadelphia. Whether such a royalty is excessive or not the fact remains that this is the tribute paid to private ownership.

The present average rate of royalty on anthracite is probably between 32 and 35 cents a ton on all sizes, which is from 12 to 14 per cent of the selling value at the mine. The minimum rate (about 10 per cent) is found in some old leases, and the maximum (20 to 27 per cent) in leases made in the last five years. R. V. Norris states that in the late sixties, when the annual output of anthracite was around 15,000,000 tons, royalties were 8 to 10 cents a ton on prepared sizes, but that no charge was made on the smaller sizes. In the seventies the rate rose to 25 cents on prepared, one-half that on pea, and one-fourth on smaller sizes. By the middle eighties, when the output was a third what it is now, the rate was about double that of the seventies—that is, 40 to 50 cents on the larger sizes and 5 to 10 cents on the smaller sizes. The tendency is still upward by reason of increases in the rates for intermediate sizes and the operation of royalty rates based on a percentage of the selling value, an increasing quantity. Figured on the output from the Girard lands, which is nearly 3 per cent of the total production, the gross return to the estate from its coal lands is over 50 cents a ton.

Nor is the increase in value of anthracite lands any less striking. At the beginning of the last century, as stated by Mr. Norris, the great bulk of these lands were patented by the State of Pennsylvania for $2 to $4 an acre; in the middle of the century the price of the best land rose to $50, and in 1875 even to $500. Now $3,000 an acre has been paid for virgin coal land, and little is on the market at that. In considering these increases in land values, the effect of interest and taxes must not be overlooked.

The bituminous coal industry is a modern institution compared with the mining of anthracite, and much of the bituminous coal land was acquired by the operating companies during the last 2 years for little if anything more than its surface value. To-day there are large areas of bituminous coal-bearing lands that, because they are undeveloped and without railroads, can be purchased at a low price, but little or no anthracite land is on the market and little has changed hands for years. The present average resource cost of bituminous coal is not much over 5 cents a ton or about 4 per cent of the average selling value at the mine.

Should you be interested in summing up all these various costs and striking a balance between labor's share and capital's return you would find that the mine worker, the trainman, and the wagon driver together receive fully half of the price of the anthracite delivered at your house, and the same three classes of labor receive not less than half the price paid by the average consumer for the cheaper soft coal. In a similar manner the average return on the capital invested in land, mining plant, railroads, and coal yard may be roughly calculated, with the result that landlord, bondholder and stockholder of coal company and railroad together receive about $1.15 from the ton of anthracite and only 50 to 75 cents from the ton of bituminous coal, and of either of these amounts the mine operator's share is only a small fraction.

### Where Possible Reductions Lie

The conservation of a natural resource, though it will undoubtedly be of direct economic benefit in the future, is not essentially a cheapening process; in fact, these increased recoveries of coal have in large part become possible only because of a higher market price. And, following further this line of thought, we may say that the increased safety in the coal mines that has come through the combined efforts of the coal companies, the State inspectors, and the Federal Bureau of Mines necessarily involves some increase in cost of operation, but the few cents per ton thus added to the cost is a small price to pay for the satisfaction of having the stain of blood removed from the coal we buy. That form of social insurance which is now enforced through the workman's compensation laws alone adds from 2 to 5 cents a ton to the cost of coal.

In the item of transportation perhaps the most promising means of relief is that of reducing the length of haul. Though many a consumer's preference for coal from a distant field over that from a field nearer home is based on special requirements, the deciding element in the preference of other consumers is simply the price, and this in turn may be largely due to a differential freight scale, which is thus not in the public interest if we admit the premise that it is wasteful to burn coal in hauling coal into coal districts or past such districts, except in so far as quality requirements absolutely demand the long-haul coal. The recent eastward movement of the higher-grade coals, in part caused by the export demand, may involve some increase in the average length of haul and thus in the transportation cost of coal not exported, but on the other hand this enforced adjustment may lead some consumers to discover nearer home sources of coal equally well suited to their purposes.

Reduction in marketing costs is a reform so close to the consumer that he should be able to find for himself whatever relief is possible. Professor Mead, of the University of Pennsylvania, is authority for the statement that the delivery of coal is costing the dealers 50 cents a ton more than is necessary.

### Royalties and Their Effects

There only remains, therefore, the first item of all—the value of the coal in the ground, or rather the return which the landowner is asking for this natural resource. The fortunate holder of coal land, whether a very human individual or a soulless cor-

poration or a large trust estate administered for benevolence only, is likely to endeavor to get all that the traffic will bear. Especially in the possession of a limited resource like anthracite, the tendency has been and will continue to be to increase royalties as the years pass, and the only penalty imposed by the State for high royalties seems to be high taxes, which too often, indeed, serve to justify the high resource cost put upon coal in the ground. Finally, in considering royalty rates or depletion charge we must not overlook the interest that accumulates throughout the period between the purchase of the coal land and the removal of the last ton of coal.

In placing a value upon the Choctaw lands some years ago the Geological Survey figured the aggregate royalties at current rates as 160 million dollars, but if that amount of royalty were to be collected through the six or seven centuries required for mining the two thousand million tons under this land, the present value of the land would be only 6½ million dollars if purchased by the Federal Government or only 4 million if purchased by the State of Oklahoma, and even less if the project were financed by a corporation that would need to issue 6 per cent bonds. Such is an illustration from actual experience in coal-land valuation—the 4 or 6 million dollars invested in these Oklahoma coal lands now would require a final return of 160 million dollars in royalties to balance the account.

More recently Mr. Cushing, the editor of Black Diamond, has figured the cost of a monopolistic control of the available coal resources east of the Rocky Mountains on the basis of the United States Geological Survey estimate of two million million tons. At a valuation of coal in the ground of only 1 cent a ton, which as he stated is less than has been paid for large holdings, this deal would require a capitalization of 20 billion dollars, and the fixed charges on the bonds of this United States Coal Corporation would require an interest charge alone of $2 a ton against a production of 600 million tons a year. Mr. Cushing characterizes such a financial undertaking in mild terms as hopelessly impossible, and yet his figures, which do not include taxes, are most enlightening as affording some measure of the cost of possessing an undeveloped resource. Incidentally, these startling figures furnish a strong argument for the present policy of the National Government in retaining ownership of the public coal lands, at least up to the time when the market conditions justify the opening of a mine and then either leasing or selling a tract only large enough for that operation. The consumer of the next century simply can not afford to have private capitalists invest to-day in coal land for their great-grandchildren to lease.

The burden that seems evitable under unregulated private ownership of a natural resource like coal is that because the lands containing these national reserves of heat and power are taxed and because the individual or corporation properly charges up interest at current rates on his large holding, the consumer must pay a resource cost which takes into account the long period of undevelopment. Even the high rates of royalty on the lands of the Girard Estate may be found less excessive than they seem if a century's taxes and interest charges are figured. Yet the fact remains that the royalty for anthracite represents a much larger proportion of the cost of the mined coal than any bituminous royalties. Moreover, we believe the highest royalty prevailing in the anthracite region has far more influences in fixing the selling price than the lower rates of the older leases.

Any study of costs in the coal industry finds its point in the question not who but what fixes the price of coal. The cost of mining coal, like the cost of living, is increasing. Exact mining costs, however, can not be determined until the operators have accomplished their reform of standardizing accounting. Too often the operator includes in his account only the two largest and most obvious items, labor and material. Thus, when the market for bituminous coal is dull, the company whose land costs little or nothing is able to set a lower limit of price than the company whose coal must stand a charge of 5 to 10 cents per ton or even more, be that charge called royalty, depletion, or amortization. At such times the operator with the larger resource cost must sell at a real though not always recognized loss, but of course with the hope of recouping himself at times of high prices like the present, if fortunately he has any coal to sell not already contracted for.

Even with the average low resource cost of bituminous coal, the state of competition that is tied up with idle and half-worked mines results in an average total cost that it little below the average selling price. Of course in this business there are those, both large operators and small, who make a profit in lean as well as in fat years, just as there are those for whom the prosperous years are too infrequent to keep them out of the hands of receivers.

Study of present conditions in the coal mining districts fails to encourage the idea of governmental operation of the seven thousand coal mines in this country. More in line with the trend of public sentiment in the last decade, however, is governmental control in the interest of the consumer by regulation of prices, and to judge from the facts of experience in the regulation of transportation of other public utilities, the public coal commissions will be given sufficient discretionary powers to safeguard the interests of producer and consumer alike, and even mandatory requirements, either legislative or executive, will be subject to judicial review.

Competition seems to have failed of late years to benefit the consumer of coal. In the bitumiuons fields the competition whenever present has been wasteful and in the anthracite fields there has been practical absence of healthy competition, and whenever too great or too little competition, the result is the same—to increase the actual cost of bituminous coal by saddling the industry and its product with the fixed charges on idle or semi-idle mines and to raise the price of anthracite coal by favoring the burdens of high resource costs.

In estimating the aggregate losses incurred by society by reason of the large number of mines not working at full capacity, the facts to be considered are that the capital invested in mine equipment asks a wage based on a year of 365 days of 24 hours, while labor's year averaged last year only 230 days in the anthracite mines and only 203 days in the bituminous mines with only 5 to 8 hours to the day.

### Public Regulation Will Prove Beneficial From Many Angles

As coal is more an interstate than intrastate commodity, any regulation of prices needs to be under Federal control, and to benefit both consumer and producer such control can not stop with transportation and mining costs but must stand ready to exercise full rights as a trustee of the people over the coal in the ground. The private owner of coal land, which derives its real value from society's needs has no more sacred right to decide whether or not that coal shall be mined when it is needed by society or to fix an exorbitant price on this indispensable national resource than the coal operators have to combine for the purpose of exacting an excessive profit from the consumer, or the railroads to charge all that the traffic may bear. The proposal to bring landowner under the same rule as mine operator and coal carrier may seem radical, but where is the point at which coal becomes the resource upon which industrial society depends for its very life?

Public regulation, however, will be fair and indeed in the long run will prove beneficial to the landowner as well as to the consumer, to the mine worker as well as to the operator, because any such agency as the Federal Trade Commission, in its control of prices, must determine costs; and as we interpret the present attitude of the whole coal-mining industry the operators are willing to rest their case on a fair determination of actual costs on which their profits may then be figured.

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## Massachusetts Companies Show Low Percentage of Unaccounted-for Gas

Twelve gas companies operated by the Gas & Electric Improvement Company, Boston, show "lost" gas at percentages ranging from 2.5 to 8.2 per cent. The low company on the list is the Gloucester Gas Light Company, which during the four months to November 1 showed an exceptionally good record. Companies having high pressure systems, of course, showed larger leakages, that of the Worcester County Gas Company, with 8.2 per cent, being one of this type. The North Adams Gas Light Company's per cent of unaccounted-for gas was only 3.28, and other companies' per cents were 4.7, 6.06, 6.2, 6.58, 6.6, 6.63, 6.71, 6.9 and 7.1.

It is pointed out by the management that leakage is an index of the care and attention given to the distribution system, and requires constant thought.

## Heat Transmission Through Various Types of Sash

A series of tests made to determine the relative heat loss through various types of wood, steel and hollow-metal sash with single and double glazing, was described by Arthur N. Sheldon, in a paper presented at the annual meeting of the American Society of Mechanical Engineers, held in New York City, Dec. 5 to 8. The apparatus was an air-tight box, one side of which was closed by the sash to be tested. An electric heater in the bottom of the test box maintained the desired temperature difference between inside and outside air. The loss of heat was computed from wattmeter readings, and a quantity *H*, the B.t.u. transmitted per 24 hour per square foot of exposed surface per degree difference of temperature, was determined for each type of sash. Tests were made at approximately 40 and 70 Deg. Fahr. temperature difference under conditions closely imitating the actual in practice. The results show that the heat loss is greater through the single-glazed sash than through the double-glazed, that it is greater through metal than through wooden sash, that it is greater through solid metal than through hollow metal sash, and that in double-glazed sash it decreases with increased air spacing between the panes of glass. The results of the tests are given in graphical and tabular form.

A typical problem, to determine the most economical type of metal sash to use in a given building, is solved by the author, using data from his tests. The saving in fuel by one type of double-glazed sash might be considered sufficient to warrant the additional first cost over a single-glazed sash, but a second type of double-glazed sash, while effecting some fuel saving, is shown not to be a paying investment.

Later in the paper the author discusses tests made to determine the cause of condensation in double-glazed sash and its prevention. It was found that leaks into the air space from the inside cause condensation, and that leaks from the outside do not. The changes in temperature, creating changes in pressure within the air space, cause a "breathing" action which alternately introduces and expels air from the air space. The warmer air, from inside the building, coming in contact with the relatively cold exterior glass, may cause condensation upon it, while the cold air from outside, coming in contact with the warm interior glass, becomes relatively drier.

The proposal is made of designing double-glazed sash with "breathing holes" in the exterior panes, and with air-tight interior panes, to prevent condensation within the air space. Factors affecting the problem are emphasized by the author.

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## Frankness and Fairness in Price Agreements

Exaggeration of statement and claim is not as prevalent as it was. Agreements and contracts are being more rigidly observed in these days of competitive prosperity. The commercial manager should aid this tendency by demanding it and by scratching all entries that do not live up to it. It is true that in some instances the manufacturer looks upon the manager as his natural prey, and the manager looks upon the manufacturer as his prey. They each try to "do" the other with the net result that both are "done." In each transaction they warily lead and spar until they see a fancied opening and then they bore in and go to the ground in a clinch until one or the other weakens and closes the deal. The victor goes to his corner and chuckles over his victory while the defeated man nurses his wounds and stores up in his memory plans to "put over" something in the next round. This reference to the squared circle for a simile is not greatly overdrawn, asserted the composite paper of the Manufacturers' Section—edited by W. W. Barnes—presented at the annual convention of the National Commercial Gas Association. Business has been carried on upon this principle in the past and we regret to say it is the platform upon which some manufacturers and managers stand to-day.

But it is all wrong. No one has gained. The manager may get an advantage at one time, he may drive a sharp bargain which thrills the manufacturer with pain but who will smilingly accept the order and fill it. Now comes a succeeding transaction. The manufacturer is likely to be loaded for the manager. He is apt to put something over himself. He may claim that it is just as good as before, when in fact it is put up specially to deceive the manager and "even up" on a previous deal. What has proceeded is, of course, largely hypothetical, but we insist that it is not impossible. We believe it is all wrong.

There should be a square deal every time. A manufacturer is entitled to a profit on his goods. His price and his profit is governed by the quality and service in his product. He must be a man of character, courageous enough to explain carefully why he can sell one article at a certain price and an almost similar article at a higher price. The fact that one article sells at a higher price indicates on the face of it that it is a better article.

Every manufacturer should explain to the manager the exact reasons for the difference. He should seek to show him that his own reputation, character and success will depend upon the showing and service that the goods make. He should avoid overstocking the manager. On the contrary he should urge him to buy judiciously, and to order frequently along an arranged schedule, subject to revision, rather than to bite off a chunk that impedes mastication and leaves him loaded up and in a condition of sales indigestion.

The manufacturer should put himself in the attitude of a partner to the commercial manager. In return the manager should meet the manufacturer in a spirit of absolute fairness. He should by no means be guided in his decision by price alone, because price does not always determine the value of an article. Every manager owes it to himself and the company he represents to give careful attention and study to claims seriously put forth by manufacturers. He should be a man competent to investigate, unbiased by any previously conceived notion, and absolutely uninfluenced except by the purpose of making a correct and honest decision on the goods offered.

He should meet the manufacturer half way and should assume a receptive attitude with an open mind concerning the goods under discussion. Then it is up to his good judgment to make his decision.

In days gone by certain commercial managers had the idea that they should advocate and buy certain lines of goods regardless of high test value, and in fact they had only in mind the lowest price offered and at which they purchased the goods. Nowadays managers of this kind are practically a thing of the past. They did not advance the company's interest. They were sacrificing in a way their own future possibilities as well as hurting the reputatioin of the company by whom they were employed. Isn't it a fact that when a commercial manager wishes to purchase something he goes into the market and tries to get all the information possible concerning the article which he wishes to purchase and then finally decides to purchase the very best article at the lowest price, taking largely into consideration the quality of material and workmanship that enter into the manufacture of the article? If a commercial manager will always follow out the idea that the very best articles manufactured are those to stock and sell he will be building for the future of his company on a sure foundation. There should be a more complete understanding relative to this phase of merchandising.

When a manager finds a line of goods which coincides with his ideas of what is necessary for his trade, he should back this line of goods with all the energy at his command just so long as the manufacturer keeps his quality up to the required standard and gives good service and then the relations of manufacturer and manager will be so cordial and intimate that any question of manufacturing detail or policy or price can be taken up on a basis fair to each side and satisfactorily settled. These conditions may seem idealistic, but they are the foundation of all good business.

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## Gas Only Utility Service that Always Responds on Demand and Never Fails Because of a Breakdown

Gas is the only utility service that always responds on demand and that never fails because of a breakdown, declared J. M. Spitzglass, of the Peoples Gas Light & Coke Company of Chicago, in his paper on rate making at the annual convention of the Pacific Coast Gas Association. Can you compare the danger of an emptied gas holder interrupting the supply with the inconvenience caused by a temporary shortage of water or the occasional interruption of electric service? The customer's demand for gas is imperative at all times.

There must be no chance-taking by economizing on equipment because of the danger that may result from occasional shortage.

On the contrary, a liberal margin must be allowed in every detail in providing for the maximum possible, or probable demand of all consumers connected to the source of supply, because a failure of gas supply at any time due to insufficient equipment means, besides the inconvenience of an interruption, danger to lives.

# News of the Gas Industry

## Municipal Ownership of Distribution Plant is a Failure in Hamilton, Ohio

Municipal ownership of gas distribution plant is a failure in Hamilton. It appears that by previously buying the natural gas at 18 cents from the Ohio Fuel Supply Company as well as now at 20 cents and retailing it at 30 cents has cost the city $188,958.80 in six years. Mayor John A. Holzberger has called a conference of business men in an effort to find a way out. It is said the leakage at present amounts to 22.25 per cent of the gas purchased.

The Mayor favors a plan offered by the Ohio Fuel Supply Company some years ago, namely to lease the mains in the city for $10,000 a year and set a maximum charge of 30 cents per 1,000 cu. ft. for gas.

## Four Michigan Townships Have Cheaper Gas

The board of directors of the Detroit City Gas Company at a recent meeting announced a voluntary reduction in the rates at which gas is supplied to Ford City, Ecorse, Oakwood and Wyandotte. These villages in future will receive gas at the same rates which are charged Detroit consumers—75 cents a thousand cubic feet, with an additional charge of 10 cents a thousand on bills not paid during the discount periods.

The reductions go into effect immediately, with the bills payable on December 15. The village of Trenton also received a reduction in gas rates, paying under the new schedule $1 a thousand cubic feet, with an additional charge of 10 cents a thousand on bills paid after discount periods.

## Cincinnati Company Offers to Refund Fees

W. W. Freeman, president of the Union Gas and Electric Company, announced yesterday that the company is prepared to recognize any valid claims for the return of $1 fees which consumers paid in years past when they moved and had the gas turned off and on. Mr. Freeman said the company already had paid back the money to consumers who made claims.

## West Virginia Gas Property Sold

In the county court documents have been filed showing the transfer of local holdings of the Wheeling and Tri-State Natural Gas companies to the Manufacturers' Light and Heat company. The Wheeling company transfers its building on Chapline Street and Brown's Run property as well as oil and gas leases on 123 acres in Triadelphia district, while the Tri-State assigns oil and gas leases on 794½ acres in Richland district.

## Contract Entered Into Between Boston and East Boston Gas Companies

An agreement between the Boston Consolidated Gas Company and the East Boston Gas Company, which supplies that portion of the city and the city of Chelsea, Mass., has been signed, calling for the sale and delivery to the latter company by the former of such quantity of gas as the East Boston company may require for the purpose of supplying its customers, not to exceed, however, 40,000,000 cu. ft. of gas per month. A copy of the contract has been filed with the Massachusetts Gas & Electric Light Commission, as required by law.

The price named is 47.5 cents per 1,000 cu. ft., to be measured at the East Boston Company's works at Chelsea. The latter company agrees to pay the Consolidated also $3,500 per year, in monthly installments, this being approximately 10 per cent of the cost of mains constructed by the Consolidated company in Chelsea, and used exclusively for the delivery of the gas sold under the contract. The East Boston company agrees that its own works shall, during the term of the agreement, be operated to the greatest extent consistent with efficiency and conomy. The agreement runs for a term of three years, beginning Dec. 1, 1916.

The East Boston Company, during the year to June 30, 1916, bought of the Consolidated company 203,295,000 cu. ft. of gas, at 45 cents per thousand feet. It manufactured during the year 113,634,000 cu. ft. of coal gas and 203,138,000 cu. ft. of water gas. Costs of manufacturing the 317,000,000 cu. ft. made at the works were $115,111, or 36 cents per thousand cu. ft., exclusive of fixed charges. Residual products netted $15,559, making the net cost, aside from charges, 31.5 cents per thousand.

The East Boston Gas Company has 11,206 customers in that district of Boston and 8,590 in Chelsea. Mr. James R. Richards is president of both companies.

## Wage Raise in Madison, Wisc.

The wages of the men in the operating department of the Madison Gas and Electric company have been raised from ten to fifteen per cent in the past year.

This is in line with the recent increase in wages granted by the gas and electric companies in New York, Chicago and Milwaukee.

In the case of several lines of work the increase in pay has been as much as twenty per cent.

"We have done this," said F. L. Cross, general manager of the local public utilities company, "because we have realized that in order to meet the jump in the prices of food which have taken place in the past year, and live comfortably, the men were entitled to an increase in their pay."

## Boston Suburban Gas Company Makes Extraordinary Meter Gain

The Arlington Gas Light Company added 456 meters during the four months ending November 1. The total now stands at 5,997. The company is doing an extensive business in Lexington and Winchester.

## Prizes Offered for Best Show Windows at Gas Office

Prizes of $10 and $5 are offered by President G. K. Dustin of the Gas & Electric Improvement Company, Boston, for the most meritorious show window decorations, in anticipation of the Christmas holidays, at the score or more of utility company offices and salesrooms throughout Massachusetts and in Vermont and Florida.

Photographs of the results of the local window trimmers' abilities will be submitted to the general offices to be passed upon.

## Chicago City Council Committee Receives Report—Recommends 55-Cent Gas

Gas for the general public at 55 cents per 1,000 cu. ft. with an additional flat ready-to-serve charge of 25 cents monthly, is what the Peoples Gas Light and Coke Company ought to furnish in Chicago for the next three years, according to a report recently made to the aldermanic committee on gas by its Prof. Edward W. Bemis, and its attorney, Donald R. Richberg. The report recommends the same heating power as at present and a reduction of one-third in the lighting power. It provides, however, that the company may reduce the heating power slightly in 1920 and 1921, and make a further reduction in lighting power, but if that is done it must be accompanied by a reduction in the price of gas to 50 cents. Otherwise the 55 cent rate is to remain in force during 1920 and 1921.

The company in its offer to the council committee provided for a division of 85 per cent to the company and 15 per cent to the consumer after the payment of bond interest and 6 per cent on future securities. The city's expert held, however, that profit sharing should be decided according to the theory on which the primary rate is made.

Instead of a primary rate of 75 cents, a secondary rate of 65 cents and a tertiary rate of 35 cents, according to consumption

and the capacity of the meter, it would seem to be wiser, stated the report, to have only two rates, a primary rate, such as would be used by domestic consumers and shops for ordinary lighting and cooking, and a secondary rate for larger users for general heating of houses or for lighting and power on a considerable scale.

"On the basis of the estimated fair value founded on the Hagenah appraisal and on the assumption of 600 B. t. u. and 15 candle power during the next three years, the rate for the first 10,000 ft. a month need not exceed 55 cents plus the readiness-to-serve charge, which would yield an average of 10 cents additional. If the standard is lowered to 575 B. t. u., and 10-candle power after 1919, the primary rate should not exceed 50 cents plus the readiness-to-serve charge."

The city's expert found that a change in the standard of gas furnished was desirable, but that the manner proposed by the company would work a hardship on a large number of small consumers. Mr. Bemis said that the gradual elimination of the candle-power standard and substitution of a heat unit standard is a progressive policy. That change, he said, is inevitable in order to obtain cheaper rates. The committee was told that in three years the company should be prepared to distribute a large amount of coal gas from at least a section of its new plant.

The committee invited William G. Woolfolk, Chicago manager for Sanderson & Porter, to reply to the Bemis-Richberg report and he agreed to present one at the next meeting of the committee Friday, Dec. 8.

"I do not want any one to go away from here with the understanding that we are ready to accept a gas rate of 55 cents a 1,000 cu. ft.," declared Mr. Woolfolk. "Neither do I want any one to think we are ready to trade. The proposition we have already offered is the best we can consider."

## Gas Replaces Coal for Baker's Oven

A baker at Milford, Mass., has just installed a Blodgett's bakers' oven with a gas consumption of 75 cu. ft. per hour, displacing coal as fuel. The oven will be run 26 days per month, 5 hours per day.

## New Equipment at Springfield, Mass.

At a hearing recently held before the Massachusetts Gas & Electric Light Commission on a petition of the Springfield Gas Light Company, A. B. Tenney, representing the company, described the new and efficient methods of operation. Recently, six benches of 8 retorts of the Glover-West continuous type have been installed, and now the total coal gas capacity is 2,500,000 cu. ft., 1,500,000 in verticals and 1,000,000 in inclined.

A tar tank has been built, with walls forming part of the foundation wall for the vertical retorts. Efficient coal and coke handling apparatus has been provided. The coal is brought in from the railroad into a hopper and is deposited either in the coal shed on Elm Street or in a crusher which deposits it on a conveying belt. It is weighed and put onto the elevator, where the coal is dumped onto another conveyor running at right angles, feeding into the bunkers over the hoppers.

The coke is taken from the retorts and deposited into a "night storage bin." This coke is for use in the boilers and for water gas purposes, besides being available for handling into teams for domestic supply. That coke is deposited by means of conveyors which run from the retort house. The balance is carried out by an overhead railway extending almost the entire length of the property. This is being extended by erecting an elevator and locomotive crane, so the coke can be rehandled from the storage pile back to the water gas and boiler house, and deposited in bins for delivery to customers.

The company has extended its distributing system liberally to meet public demands, said Mr. Tenney. The high pressure system has been extended from Chicopee to supply South Hadley. In addition, a high pressure main has been extended through West Springfield and Agawam to Longmeadow, for local supply and to reinforce existing pressure, besides providing a means for delivering gas to the Northern Connecticut Light & Power Company. A meter house for measuring the gas sold to the latter company has been built at Longmeadow.

The Springfield company is now constructing a 16-in. main as a "belt line" through the heart of Springfield, in order to maintain a proper pressure in outlying districts.

Laying of new gas mains as follows: 910 feet 2 inch; 13,840 feet 3 inch; 625 feet 4 inch; 1,600 feet 6 inch. In addition the company has replaced 2,790 feet of 1¼ inch main with 3 inch pipe to improve the service, as well as extensive additional improvements on lines already laid.

The increase in the company's gas output for the year is nearly nine million cubic feet. It has added 303 new services.

All trunk lines of city heating system relaid and enlarged.

That, in brief, is what the gas company has done in less than a year to increase its efficiency in La Crosse. It is far more than the city has spent for improvement. Good service is not enough. The Wisconsin-Minnesota Light and Power company intends to approximate perfect service, so far as that is humanly possible.

## Lecturer Tells of Early Gas and of Gas To-day

"A dollar a day to-day will pay for more than ten times as much light as this same amount would have paid for ten years ago," said Prof. F. K. Richtmyer, '04 of the Department of Physics at Syracuse University, in his illustrated lecture on "New Methods of Artificial Lighting" before the University Club. "In fact, light is one of the very few commodities whose cost has decreased.

"This is due wholly to the rapid strides made in the history of artificial lighting. At the end of the sixteenth century, an Englishman named Murdock succeeded for the first time in lighting a house by illuminating gas. Yet it was not until almost three hundred years later that a community was successfully illuminated by a lighting system. This occurred in London in 1815. After that time, various factors sprang up to delay the general introduction of gas lighting, and it was not until many years later that gas lights became common.

"Of the three kinds of lighting generally in use to-day—direct, indirect, and semi-direct—the direct is the most efficient where sharp shadows are required, like in a printing office or department store. Indirect lights throw no shadows and are so called because they throw the light onto the ceiling by means of an inverted bowl in order to protect the eye from the light source. A system of this kind has but recently been installed in the reference room of the University library. Semi-direct units have been designed to secure an average between the two. Here a bowl is used that is similar to the one made use of in indirect lighting, except that it is translucent."

## Hot Water by Means of Gas at Low Cost in Boston

A customer of the Boston Consolidated Gas Company has placed an order for water heating apparatus which will produce 325 gals. of hot water per hour at a cost for gas of only 8 cents per gallon.

The company has featured this installation in Boston newspapers in an effective typographical setting which is being used as standard from week to week, in setting forth new installations of industrial gas uses. The central theme of the advertisement is the reiterated phrase: "Gas has 1,000 uses; let us find a new use for you."

## Bozeman Votes Franchise By Wide Margin

With substantially a unanimous vote the freeholders of Bozeman, Mont., gave authority for a franchise grant to the Gallatin Valley Gas Company to install a plant and operate it in the city.

The vote was 237 votes in favor of the franchise and eight against. Confident in the outcome of the election, the men at the head of the company had incorporated, and will immediately complete their plans and designs for the machinery which will be manufactured in the east and shipped out to Bozeman for an early start on the construction of the building next spring.

Twelve miles of mains will be laid to start with, according to Robert W. Lysle of Chicago, who is the engineer and contractor in charge. The intention is to extend the mains at the start to the college, and out into the principal residence sections of Bozeman. As soon as practicable the gas company will open a display room for the purpose of exhibiting to prospective customers the various stoves and utensils in use where gas is available.

## Chattanooga Company May Build New Coke Oven Plant

The Chattanooga Gas Company is considering entering the metallurgical coke industry incidental to vastly improving its facilities for producing gas. This will mean the establishment of a new coke oven plant in Chattanooga if the project is materialized. Manager S. E. DeFrese has returned from Pittsburgh, where he went for a conference with officials of the Koppers company, which manufactures coke ovens and operates them in part or in entirety in some places.

"I looked into the possibility of a new coke oven plant for Chattanooga, and everything looks satisfactory so far," said Mr. DeFrese. "The coke ovens in Alton Park have proven a failure so far as the gas company's interests are concerned. There is no more that can be said at this time."

The Chattanooga Gas Company is understood to have been disappointed in its operation with the Chattanooga Gas & Coal Products Company, of Alton Park. The coke ovens are expected to produce enough gas for their own fuel and then enough more to supply the Chattanooga Gas Company so that it can abandon its own plant.

## New York Company Awarded Contract for 60 By-Product Ovens in Alabama

The Otto Coking Company, Inc., of New York City, has received a contract for the erection of 60 Wilputte by-product coke ovens at the plant of the Woodward Iron Company, Woodward, Alabama.

The new ovens will have a capacity of 13 net tons of coal, and will operate on an 18-hour coking time. Work is being rushed on the construction, and the new battery is scheduled to start operation about July, 1917.

## Many Employees of Canadian Gas Company in Country's Service in European War

More than three hundred and fifty employees of the Consumers' Gas Company of Toronto, Ont., have responded to their country's call for military service in the European War up to the present time. Of these 258 are now in active service, 23 were killed in action, 2 died in the service, 37 have been reported wounded, 2 have been reported missing, 6 have been reported as prisoners of war, 2 have been discharged on account of wounds, 2 have been discharged upon the expiration of their enlistments and 18 have been rejected or discharged as medically unfit.

## Old Colony Gas Shows Large Increase

The output of Old Colony Gas Company, of Braintree, Mass., for the month of November was 7,033,000 cubic feet as compared with 5,747,000 cubic feet for the same month of the previous year, an increase of over 22 per cent. The second of a series of domestic science lectures has been given at the Whitman office of the Old Colony Gas Company by Miss Marion Low, the company's demonstrator. These lectures are being well attended and much enthusiasm is being shown and appreciation expressed for the demonstration. There will be five more of these demonstrations to which the public is cordially invited. Prizes of various sorts will be given at each of these lectures.

## Gas Industry Making Great Strides in Japan

It is only in the last few years that the gas industry in Japan has taken a new lease on life, for practically all of the companies now operating, of which there are more than 50, have been established in the last few years.

Japanese industrial development moves rather slowly and a growth of one branch as rapid as the gas field offers is rare enough to gain special attention.

This development is chiefly due to the scientific manner in which the Japanese are making use of the best of modern gas theories as well as the most profitable installations and appliances.

Although the greatest amount of gas is still being used for illumination, the gas companies are putting forth their best efforts to educate the manufacturers to the great opportunities awaiting the use of gas for industrial fuel.

## Rates Reduced for Hanford, Cal.

A reduction of 20 cents per 1,000 cu. ft. of gas, effective on January 1 next, is announced by the Hanford Gas & Power Company. The new rates have been approved by the State Railroad Commission, states E. E. Bush, the company's secretary. The reduction will mean that the rate is reduced to $1.60 on the first 1,000 feet of gas, with a further saving of 10 cents per thousand feet on the next 4,000 feet.

The company has made application to the State Railroad Commission to permit it to increase its bonded indebtedness to $30,000. This is desired in order that extensions can be made and a high pressure system installed.

According to Mr. Bush, there have been no further developments regarding the sale of the system to the Central California Gas Company.

### Board of Education Opposes Increase in Rates

A meeting of officials of the Equitable Gas Company, a subsidiary of the Philadelphia Company, and members of the Board of Public Education of Pittsburgh, Pa., has been arranged for, to discuss the question of increased gas rates. The increase would add about $7,500 to the public school bill.

A complaint against the new rates, which was to have been sent to the Public Service Commission, is held up pending the result of the meeting.

### Massachusetts Gas Shows Gain For November

The output of the Boston Consolidated Gas Company in November was 524,258,000 cu. ft., an increase of 7.3 per cent over the same month last year. The October output showed a gain of 8.4 per cent and the September output a gain of 13.3 per cent.

### Los Angeles Seeks Lower Rates—May Resort to Municipal Ownership

The gas situation is now before the State Railroad Commission in the suit instituted by the city of Los Angeles, Cal., some months ago and the decision is anxiously awaited.

The Economic Gas company has filed a sliding scale of rates with the railroad commission which may be the means of settling the dispute. Lest the commission's decision does not benefit the city, the Mayor is looking into the necessary steps to provide municipal ownership of the plant.

## Gas Turned into Big Compressor Plant

The Standard Oil Company turned gas into the lines of its new compressor plant in Taft, Cal., on the famous McNee lease, on section 36, 31-23, and it was given its full initial tryout. The plant is one of the largest in the state used for the compression of gas of both high and low pressure. Combined with the plant, which was built some months ago, 20,000,000 cubic feet of gas can be handled daily. This is but 3,000,000 cubic feet less than can be handled by the compressor plant of the Southern California Gas Company, which is concede to be the largest compressor in the fields. The new plant of the Standard just completed is of five units each, with a capacity of 500 horse-power. The original plant is of similar size but is now equipped to handle both high and low pressure gas.

## Increased Costs But Rates Remain Same

The Minneapolis Gas Light Company reports that the costs of the materials which it must buy to produce gas and serve it to the public are far above normal. However, under its franchise a change in the rates on gas may not be made until 1918.

L. F. Blyler, business manager of the gas company, has given some percentage increases in the prices of the most used materials

as compared with "normal" prices, meaning those of two years ago when the war began.

| | Pet. inc. |
|---|---|
| Oil used in gas manufacture | 75.9 |
| Coal used in gas manufacture | 6.56 |
| Steam coal | 6.42 |
| Standard meters | 11.5 |
| Pre-payment meters | 7.24 |
| Pig lead | 106.8 |
| Iron pipe | 22.42 |
| Wrought iron pipe | 14.12 |

"Unlike many dealers who are able to raise prices on their product in keeping with the increased cost to produce, we can do nothing," Mr. Blyler said, "even if prices on things we have to buy go still higher, but 'grin and bear it.' By our contract with the city, negotiations for a change in the gas rate to consumers may be entered into only every five years."

### Josiah Quincy Bennett Dead

Josiah Quincy Bennett, a prominent Boston capitalist and president of a large number of public service corporations, died at his home in Cambridge, Mass., November 29, aged 62 years. He was president of the Commonwealth Gas & Electric, the Athol Gas & Electric, and Marlboro-Hudson Gas companies, besides a number of electric light companies.

Mr. Bennett was born in Somerville, Mass., and was educated in the local common and high schools. He first became a bank messenger and later became cashier of the Market National Bank, Boston. Afterward, he became president of the Mercantile Trust Company. He later became associated with various industrial interests and was a director in about a score of corporations in Massachusetts.

## Societies and Associations

THE PHILADELPHIA GAS WORKS SECTION of the National Commercial Gas Association recently held their November meeting in Turngemeinde Hall, Phila., at which there were about 1,300 members present. The annual election of the officers took place with the following results: president, T. G. Williams; vice-presidents, G. E. Beck, L. H. Wertley and W. G. Murfit; secretary and treasurer, S. L. Eichengreen; executive committee, H. S. Christman, T. J. Carney and W. T. Crouse. Several cups were presented for baseball and tennis, and a six act vaudeville show provided some of the entertainment.

## Personal Notes

E. B. MOONEY, new business manager of the Brockton Gas Light Company of Brockton, Mass., has been transferred to the main extension department, and will devote his attention to this phase of the business.

GEORGE SUMMERS, consulting engineer, recently returned to Indianapolis from Bethlehem, Pa., where he has been engaged for the past three or four weeks inspecting the coke oven plant of the Lehigh Coke Company of that city.

A. H. SIKES, of Wausau, Wis., who has been sales manager for the Wisconsin Valley Electric Company, is to be the new manager of the gas company in Stevens Point, Wis. H. G. Quandt, who has been in the sales department at Wausau, is now to become local sales manager at Stevens Point, Wis.

E. LUTHER JOY, vice-president of the East Newark Gas Company, and a leading banker of New Jersey, died at his home, 994 Broad Street, Newark, Nov. 24.

THE TERRY STEAM TURBINE COMPANY of Hartford, Conn., announce the appointment of Stephenson & Nichols, Monadnock building, San Francisco, as their representatives in Northern and Central California and the Northern part of Nevada.

W. W. SCRANTON, 72 years old, president and personal owner of the Scranton Gas & Electric Company, and the wealthiest man in Scranton, Pa., died suddenly December 3. Mr. Scranton was the son of the founder of the city, and introduced the Bessemer process of steel making in this country.

E. S. PALMER, of Knoxville, Tenn., has succeeded Herman P. Fancher as commercial manager of the Lebanon (Pa.) Gas & Fuel Company. Mr. Fancher is to become commercial manager of the Doherty operating company at Knoxville, Tenn.

HARVEY B. LONG, for many years an employee in the commercial department of the Peoples Gas Light & Coke Company, Chicago, Ill., recently died after a long confining illness.

G. W. ALLEN, educational director of the Consumers Gas Company, Toronto, has recently given his illustrated lecture in New Bedford, Mass., on the "History, Manufacture and Development of Gas."

JOHN W. BATTEN, engineer for the Detroit City Gas Company, recently gave an address to the Detroit Engineering Society on the "Manufacture and Distribution of Gas."

HENRY L. READ, of the engineering department of the Surface Combustion Company of Long Island City, N. Y., who wrote the article on converting coal-fired brick bake ovens to gas, which was published in the Nov. 27 issue of this journal, was injured when an automobile in which he was riding, Dec. 2, overturned near Hempstead, L. I.

FRANCIS COLTON, formerly connected with the Public Service Construction Company, of 30 Broad Street, New York City, has been appointed to a position with the Kennebec Gas & Fuel Company of Waterville, Me., where he will work under the direction of W. H. Fritchman.

## Construction Notes

### Montpelier, Vt., May Have New Lights

E. T. Kelley of the head office of the Twin State Gas & Electric Company, and W. H. Richardson, manager of the Brattleboro division, have consulted with the commissioners of Montpelier relative to a new system of lighting for Main Street and intersecting streets. The subject was considered from various aspects and it was left that written estimates of the cost to the village for a new system having ornamental posts should be submitted to the commissioners in a few days. The estimates may result in a special village meeting.

### Line from Webster to Southbridge Practically Completed

The Webster & Southbridge Gas & Electric Company has practically completed the laying of a pipe line which will connect Southbridge with the central gas plant at Webster, Mass. The gas will be sent through the four-inch steel pipe, every joint being welded, so it will be practically one continuous pipe line for 11 or 12 miles. The gas will be under a pressure of 40 pounds at Webster when it is being pushed to Southbridge, and the pressure will be increased to 60 pounds if necessary.

### Vast Improvements Made By Wisconsin-Minnesota Company

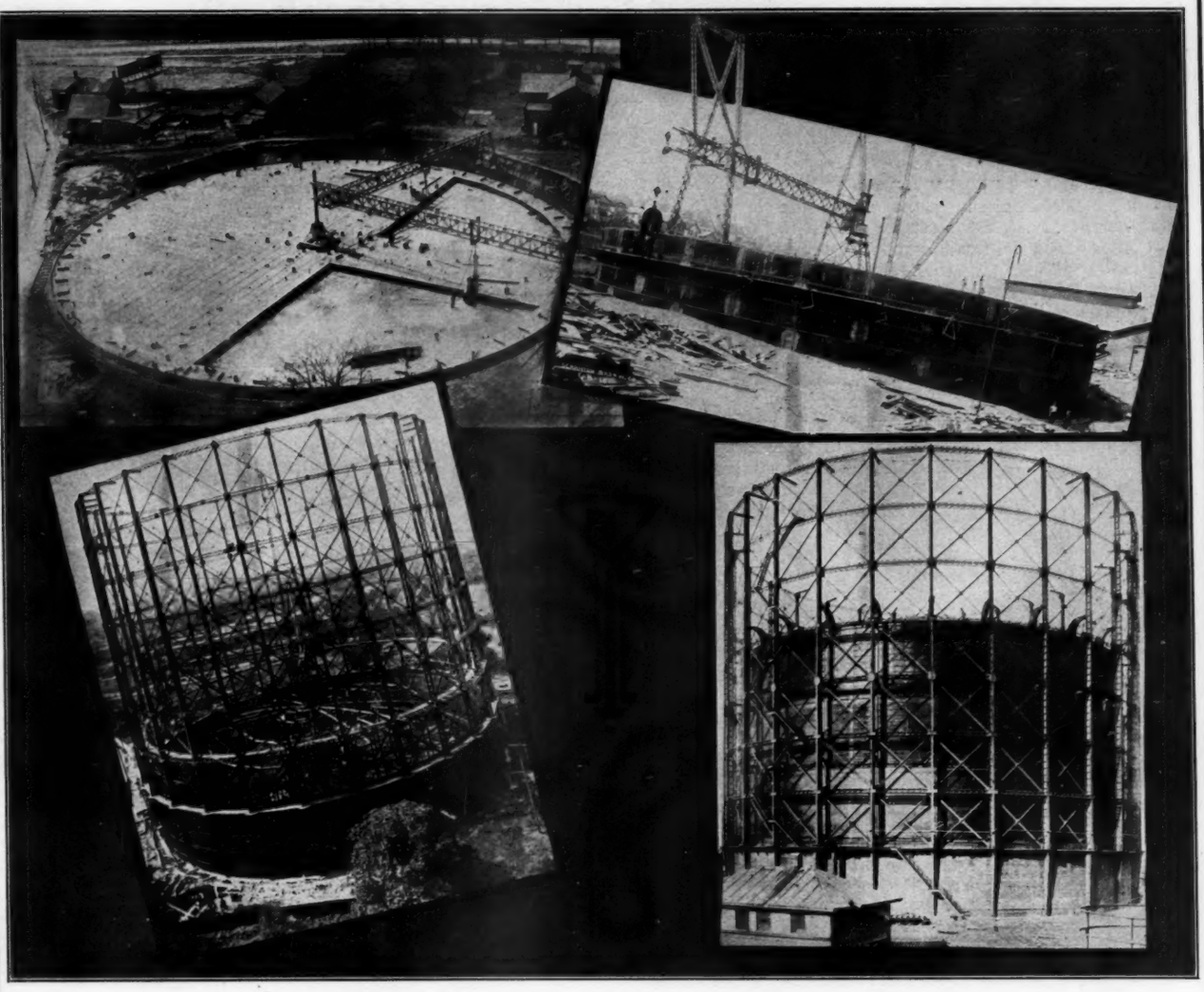
The Wisconsin-Minnesota Light and Power company has expended no less than $350,000 in improving its service in La Crosse, Wis., within the past year. This includes $275,000 for the erection of an entire new station and equipment at Second and Jay Streets, and innumerable extensions of its electric light and gas lines.

### New Main from Sparrows Point to Baltimore

In keeping with the development of the steel works at Sparrows Point and the enlargement of the coke ovens there, the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., is preparing to enlarge its facilities for getting gas from the coke ovens of which it is a by-product.

It is found that the present main, which runs from the coke ovens at the Point to Baltimore city, and at present supplies more than half the gas used in the city, is not big enough to convey

*(Continued on Page 16 Advertising Section)*



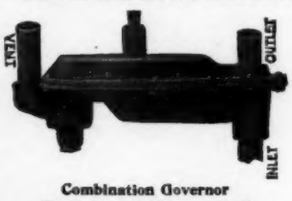
RITER-CONLEY COMPANY

STEEL CONSTRUCTION

PITTSBURGH

REYNOLDS GOVERNORS

We make anything desired in the GAS GOVERNOR or REGULATOR to meet any and all classes of reductions. Stations for DISTRICT SERVICE, INDIVIDUAL HIGH PRESSURE GOVERNORS for reducing high pressure gas to inches of water. Holder and Low Pressure Service Governors. A steady, uniform pressure can be obtained by using REYNOLDS GOVERNORS, "THE WORLD'S STANDARD." We make a specialty of the Governor business, devoting our entire time to the manufacture of same. All Governors are GUARANTEED.




Combination Governor
Governor and Mercury Seal

REYNOLD'S GAS REGULATOR COMPANY
ANDERSON, INDIANA. U. S. A.

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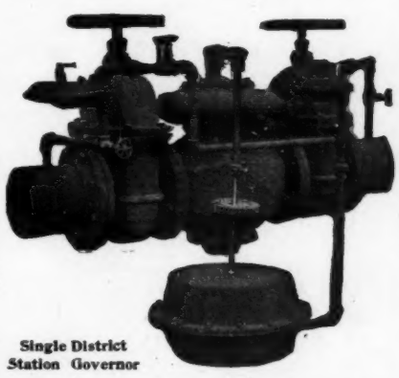

Single District
Station Governor

(Continued from Page 408)

all the gas that will be produced at the steel works in the near future. The gas company is preparing to lay another main, so it was said by an official of that company.

By the use of the coke-oven gas in larger proportions the company will have to make less gas at its water-gas plants in this city. The water-gas at prevailing prices of the raw materials costs considerably more than the Sparrows Point gas.

### Progress on the Danbury, Conn., Property

The work of clearing away the old Lee factory on the land recently purchased by the Danbury and Bethel Gas & Electric Light Company, on Railroad avenue, is progressing rapidly and present indications are that the land will be clear before the first of the year. The company is having a spur trestle constructed over a portion of the land now open and it is probable that the company will get its coal direct from the mines in the future, instead of buying it from one of the local coal merchants.

### Soon to Remodel Office Building in Marion, Ill.

The Southern Illinois Gas Company will at an early date begin the work of remodeling its Marion office building, the Mrs. Letha Lowe building on the southeast corner of the public square. which it purchased a few weeks ago in contemplation of making it the company's home. The contract for the remodeling and building of the second story extension has been given. Charley Rainey, local contractor, received the award.

### Gas Company Builds Steam Pipe Line to Prevent Holder Cups Freezing

The Northampton (Mass.) Gas Light Company has constructed a 1 inch steam line across Mill River to keep the seals on its large storage holder from freezing. The line is suspended from two heavy steel cables. The water in the lower cup of the holder is kept in circulation by three syphons and the upper cup by one syphon.

### Larger Gas Mains Laid in College Town

The Williamstown (Mass.) Gas Company has laid 1,000 ft. of 4-in. mains in the vicinity of Meacham street, and will soon lay 500 feet more on West Main street.

### Permit Granted for La Belle Gas Plant

The La Belle Iron Works has been granted a permit to construct a six-tank gas supply plant. The plant will be located at McColloch and Twenty-ninth Streets, Wheeling, W. Va. It is estimated that $18,000 will cover the cost.

### Contract Awarded in Grand Rapids

The contract for building the three-story steel construction brick building for the Rathbone estate on Division Avenue, N., to be occupied by the Grand Rapids Gas Light Company, has been awarded to John McNabb & Son, of Grand Rapids, Mich. The building will cost about $50,000.

### Empire Gas & Pipe Line Company Lets Contract

Empire Gas & Pipe Line Company, a subsidiary of Cities Service Company, has let a contract for construction of an eight-inch pipe line from the Augusta, Kan., oil field to the refinery at Podca, recently purchased by Cities Service interests.

BEVERLY, MASS.—The Beverly Gas & Electric Company applied for permission to open Bisson and School Streets for services.

MANCHESTER, N. H.—An extension of the gas main from 110 Massabesic street is being made to the six-tenement block, recently built, in the adjoining field.

CINCINNATI, O.—The Union Gas & Electric Company has awarded the contract for the $300,000 superstructure of the new power plant on the river front.

## Financial Notes

THE OHIO FUEL SUPPLY COMPANY OF COLUMBUS has been authorized by the public utilities commission to sell $7,615,125 of capital stock to purchase three smaller gas companies and to retire some of its bonds. The stock is to sell at not less than par. The companies to be acquired are the Central Contract & Finance Company of Columbus, for which $1,185,875 will be paid; the Central Gas Company of Urbana, for which $25,000 will be paid, and for 2,129 shares of the Miami Valley Fuel & Gas Company, for which $289,112 will be paid. The bonds to be retired amount to $6,115,125.

THE MASSILLON, OHIO, ELECTRIC & GAS COMPANY has completed arrangements to refund its closed first mortgage bond issue, amounting to $500,000, maturing in 1948, with a new issue of bonds amounting to $2,000,000, to mature in 1956.

THE EMPIRE GAS & ELECTRIC COMPANY has been authorized by the Kansas public utility commission to do business in Kansas. The order of the commission may cause the sale of the Kansas Natural Gas Company to the Empire Gas & Electric Company.

THE PINE BLUFF COMPANY'S gross earnings for October were $23,242 compared with $21,132 in 1915. Net earnings for that period were $11,100, compared with $9,876 in 1915. For 12 months ended October 31 gross was $266,739, an increase of $13,665, and net $127,941, a gain of $18,591.

### Current Prices of Public Utility Securities

| | Bid | Asked |
|---|---|---|
| Adirondack Elec. P. | 25 | 27 |
| Adirondack Elec. P. pf. | 84 | 86 |
| American Gas | 120 | 123 |
| *American Gas & Electric | 152 | 155 |
| *American Gas & Electric pf. | 50 | 52 |
| American Light & Traction | 380 | 384 |
| American Light & Traction pf. | 112 | 114 |
| American Power & Light | 79 | 81 |
| American Power & Light pf. | 86 | 88 |
| American Public Utilities | 40 | 44 |
| American Public Utilities pf. | 72 | 75 |
| American Water W. & Elec. | 13¼ | 14¼ |
| Amer. W. W. & E. 1st pf. | 73 | 76 |
| Amer. W. W. & E. Part'p pf. | 29 | 32 |
| Carolina Pow. & Lt. | 36 | 38 |
| Carolina Pow. & Lt. pf. | 97 | 100 |
| Cities Service | 326 | 329 |
| Cities Service pf. | 92 | 94 |
| Colorado Power | 30 | 33 |
| Colorado Power pf. | 101 | 105 |
| Commonwealth, Pr. Ry. & Lt. | 60 | 63 |
| Commonwealth, Pr. Ry. & Lt. pf. | 83 | 85 |
| Electric Bond & Share pf. | 98 | 102 |
| Empire District El. pf. | 90 | 95 |
| Federal Light & Traction | 17 | 19 |
| Federal Light & Traction pf. | 55 | 58 |
| Gas & Electric Securities | 300 | 325 |
| Gas & Electric Securities pf. | 95 | 100 |
| Northern States Power | 107 | 110 |
| Northern States Power pf. | 100 | 101½ |
| North. Ont. Lt. & P. | 14 | 17 |
| North. Ont. Lt. & P. pf. | 57 | 62 |
| Ozark Power & Water | 44 | 48 |
| Pacific Gas & Electric | 66 | 67 |
| Pacific Gas & Electric pf. | 90½ | 92½ |
| Republic Ry. & Light Co. | 52½ | 56½ |
| Republic Ry. & Light Co. pf. | 78 | 80 |
| *Standard Gas & Electric | 16 | 17 |
| *Standard Gas & Electric pf. | 43½ | 44½ |
| So. Cal. Edison | 90 | 92 |
| So. Cal. Edison pf. | 106 | 108 |
| Tennessee Ry., Light & Power | 10½ | 11½ |
| Tennessee Ry., Light & Power pf. | 47 | 49 |
| United Light & Railways | 50 | 52 |
| United Light & Railways 1st pf. | 78 | 80 |
| Western Power | 19 | 21 |
| Western Power pf. | 70 | 72 |

*Par value $50